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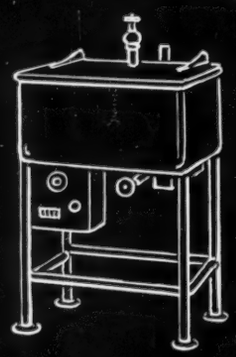

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VOLUME 44 AUGUST, 1946 NUMBER 8

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Publication Office

11 West 42nd St., New York 18, N. Y. Telephone: PEnnsylvania 6-0226

SUBSCRIPTION PRICES: United States, $3.00 and Canada, $3.00 per year. Other countries $2.50. Single copies 35c. Please remit by check or money order; cash should be registered.
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Burring, Buffing and Polishing... Manufacturers and Specialists in the Development of Production Methods and Compositions

VOL. 44, NO. 8 METAL FINISHING AUGUST, 1946
PREPARATION, ELECTROPLATING, COATING

A Standard for Gold Plating

A proposed new commercial standard for gold plated articles has been formulated and submitted jointly by the Jewelers' Vigilance Committee and the New England Manufacturing Jewelers' & Silversmiths' Association. The text of this standard will be circulated by the National Bureau of Standards for comments and suggestions, which will be considered and incorporated in a final draft to be submitted to a vote of the industry.

The standard specifies a *minimum* thickness on significant surfaces of 0.000007" of fine gold before the article can be marked "gold electroplate." Articles with gold deposits below this figure may not be described as gold plated but only as gold washed, gold colored, etc. There is a joker in the definition of *significant surfaces*, which include those surfaces "which, when in service, are visible OR are subject to wear or corrosion (*our caps*)." That one word, if not changed to "and", can provide a potent weapon for the Federal Trade Commission, which, in the past, has been known to place an interpretation all its own on things. There are areas on many articles of jewelry which are visible but recessed so deeply and so shielded that anything more than a mere gold color is economically unfeasible, despite the relatively good throwing power of the cyanide gold plating bath.

We do not believe this standard will serve the interests of either the novelty and jewelry industry or the field of electroplating in general. Electroplated gold is so soft that it is of very little importance whether the thickness be 0.000007" or 0.000001". If the article is to stand up in service a good lacquer coating is a prime requisite. Application of a quality mark will only mislead the purchaser into expecting a finish comparable to rolled gold or gold filled in wear and corrosion resistance. His subsequent opinion of electroplated gold as a *quality* finish will, by association, probably include all electroplating. Unless the quality implied by adherence to a standard is a high quality, we can see no advantage in formulating such standard.

All gold platers and manufacturers of gold plated articles should obtain copies of this proposed standard and examine it carefully since, if the industry vote is affirmative, as it generally is, it will then become a commercial standard with all the force of a law behind it.

Films and Surface Cleanliness

By JAY C. HARRIS

Central Research Department, Monsanto Chemical Company, Dayton, Ohio

CLEANLINESS, like everything else, is relative, and surfaces are multitudinous. It is, consequently, desirable that we examine these relative terms more closely. Surfaces may be said to be unclean when coated by some undesired material, but complete removal may be neither necessary nor readily possible. On the other hand, presence of otherwise useful or usually innocuous materials, in regular or irregular distribution, may be the source of considerable processing difficulty. Coatings evident to the eye may indicate the presence of either necessary or undesired materials, but this paper will be confined to a discussion of almost invisible thin coatings or films of material which may be present on metal surfaces and yet cause imperfectly processed work. In a discussion of films on surfaces it will be interesting to consider their dimensions, means for measurement, and their possible effect upon subsequent treatment.

The science of measurement progresses by improvement in the degree of resolution, closing apparent gaps in a system. In the development of optical systems for example, the telescope permitted viewing at a distance so that objects several miles away became visible. Subsequent improvements in optical systems permitted the astronomer to see stars hundreds of light years away from the earth. At the opposite extreme, the microscope increased sensitivity in the measurement of extremely small objects, but ultimately a limit of useful magnification of slightly above 1000 diameters was reached. Use of ultraviolet permitted 3-4 thousand times useful magnification. The next significant improvement in visual inspection of surfaces was the electron microscope in which magnifications of 100,000 diameters became available. Over and beyond this limit lie the indirect methods of investigation by x-ray or electron diffraction, whereby surfaces in the order of one one-hundred millionth of a centimeter can be measured. The foregoing discussion should high-light the relative character of size measurements.

Films of dirt, soil, or undesired material on metal surfaces then are relative in size, and may vary tremendously in thickness. Macroscopic films are easily apparent, but microscopic or submicroscopic films may be the cause for considerable concern. Cleanliness therefore is a relative matter, and many practical instances have been described[1] where the presence of certain impurities or contaminants have had negligible effect upon subsequent operations.

It is the intention of this paper to discuss surface films in relation to practical operations, but to do so, the subject of metal surfaces themselves should be considered.

Metal Surfaces

Critical examination of metal surfaces will reveal discontinuities, porosity, crevices, inclusion of oxide particles, striations due to mechanical treatment, and other common faults not readily apparent to the eye. Drawing operations, buffing, polishing and other mechanical treatment may result in unsound films of stressed, distorted or disordered metal.

Drawing operations may result in striations due to imperfections in the die or to inclusion of abrasive particles, and these may be the foci for difficulty in subsequent treatment. Deformation at low temperature results in crystals gliding over one another and along slip-planes and at grain boundaries so that disorganized matter is produced. Subsequent annealing may result in new crystal growth from nuclei in the disorganized layer, resulting in new crystal boundaries and thus in altered surface characteristics.[2]

Pickling treatment may leave particles of abrasive carbide, carbon, or silica on the basis metal which, if not removed, may result in surface blemishes upon later processing. Incomplete removal of acid or acid salts may result in surface corrosion, so that electrodeposits become spotty or blister.

Abrasion of the surface may be required to remove excess metal, or buffing and polishing may be resorted to in order to provide a smooth or mirror-like surface. Abrasion results in less flow, but the layer of disorganized material is greater. During the buffing or polishing operation very mild abrasives embedded in waxes or greases are applied to the metal

TABLE I

TABLE OF WAVE LENGTHS

1 Å or AU Equals 10^{-8} Cm.

Type of Ray	*Wave Length AU*	*Generation*
Gamma Rays	0.01-1.4	When atomic nuclei
	0.06-0.5	disintegrate.
X-Ray	0.06-1019	Sudden stoppage of fast moving electrons.
Ultraviolet	136-3900	Radiated from very hot bodies and emitted by ionized gases.
Visible	3900-7700	Same as ultraviolet.
Violet	3900-4220	
Blue	4220-4920	
Green	4920-5350	
Yellow	5350-5860	
Orange	5860-6470	
Red	6470-7700	
Infrared	7700-4x10^6	Heat radiation.
Solar Radiation	Those reaching the earth 2960-53000	

surface, and the basis metal may actually be flowed over areas of grease and wax leaving an unsound surface which develops into defects upon subsequent processing.[3] If the metal is not actually flowed over the greasy surface, the grease or wax may be forced into uneven surfaces or into crevices resulting in areas which later act as resist spots.

It is thus apparent that metal surfaces are variable in character, dependent upon the treatments to which they have been subjected. Films of various materials, even of basis metal may be present and it will be of interest to examine certain of these.

Films

Perhaps the most common film on metal is that resulting from oxidation. Under all but exceptional laboratory conditions an oxide film will begin formation upon a fresh metal surface almost immediately. Certain investigators using careful laboratory technic showed that abrasion of copper, even under benzene or toluene, produced oxide films greater than those normally formed by mere exposure to air.[4] Apparently

TABLE II

THICKNESS OF OXIDE FILMS ON IRON

Color	*Thickness — Å*
Straw	460
Reddish Brown	520
Red Brown	580
Purple	630
Violet	680
Blue	720

an increase in temperature is induced by abrasion which increased the tendency toward oxidation even under inert liquids. They also found that these films were independent of abrasive size over a range of No. 000 to No. 1 Hubert French emery (0.01-0.04 mm. diameter grains).

Since film thickness is of very definite interest it will be well to define the units of measurement, and to make comparisons to bring them to a practical basis. Table I[6] shows a selected list of wavelengths generated by various sources. It is apparent from this that visible light has comparatively long wavelength, and that for an oxide film to be visible to the eye, it would have to be of considerable thickness. There are several methods for measurement of film thickness[2], the most usual being by optical interference or polarization. A very sensitive method more recently developed employs a high vacuum micro-balance system.[6]

Thicknesses of invisible oxide films on iron are given in Table II[2] and the thickness of stationary films on smooth metal surfaces is given in Table III. The visible oxide films on iron are considerably greater than the stationary films in Table III. These latter generally may be detected by photographic emulsions (because these emulsions are considerably more light sensitive than the eye), but more generally the optical methods previously mentioned are used. Ordinary oxide films on copper, iron and aluminum grow rapidly at room temperature to thicknesses of the order of 20-40 Å.

It is interesting that the porosity of oxide films varies from metal to metal[2] or even with the same metal, depending upon treatment. Air-formed oxide film on iron is nearly

TABLE III

THICKNESS OF STATIONARY FILMS

Metal	*Thickness Å*
Mercury in dry air	15-20
Aluminum in dry air	100-150
Iron in dry air	15-25
Austenitic stainless in dry air	10-20
Iron or steel treated anodically in sulfuric acid solution	40
Iron treated anodically in neutral sulfate solution	60-80

1000 times as porous as that on aluminum, while the hydrated oxide film often produced on wet iron surfaces is still more porous. Induced oxide films on aluminum are hard and resistant to abrasion, while those on other metals may quite easily be ruptured.

Films other than oxides are common, but of most interest are those deposited to protect the basis metal. These comprise phosphate coatings, chromium containing films, those comprising acid inhibitors, and others resulting from cleaning and rinsing processes. A more thorough discussion of these films will be given under the specific applications.

Corrosion

Oxide films have already been discussed to some extent, but a few special cases warrant further consideration: They may continue to grow in size under high temperature conditions and, as shown for iron, these attain considerable thickness. Certain of these iron oxide films are highly resistant to conditions under which untreated surfaces would corrode badly and become unsightly. Aluminum is a metal which readily forms a very thin film of oxide which effectively prevents further corrosion. This film is self-healing and accounts for the desirable characteristics of the metal and its alloys, especially as the film oftentimes is discernable only upon close inspection.

Those metals which form oxides of discontinuous or porous characteristics will, in general, be more subject to corrosion: Consequently some means for preventing their corrosion is desirable. Our specialized interest in corrosion lies to considerable extent in the formation of oxide films, but more especially in chemical or electrochemical processes of corrosion. The source of our interest in chemical or electrochemical corrosion is the variety of chemicals with which a metal may potentially come into contact during cleaning process.

The inclusion of metallic salts in porous metals after pickling may markedly influence electroplating or organic coating, simply because of discontinuities in the surface and potential continuance of corrosion under the surface of such coatings, or in pitting with subsequent coating failure. A simplified mechanism of acid corrosion is that of hydrochloric acid on iron:

$$Fe + 2H^{+}Cl^{-} \rightarrow Fe^{++}Cl_2^{--} + H_2\uparrow$$
$$Fe^{++}Cl_2^{--} + 2HOH \rightarrow Fe(OH)_2 + 2H^{+}Cl^{-}$$

Similar effects can be produced by the hydrolysis of salts of the strong acids. In the case of organic coatings and moist sodium chloride, active hydroxide ions would be formed and these in turn could react with an organic coating, caus-

ing failure, where the action of dry sodium chloride or slightly acid salts would prove negligible.

Galvanic or two-metal cells in the presence of electrolyte will cause corrosion, as will concentration or solution cells. The fact that corrosion is difficult to control is one of the reasons for the wide variety of available corrosion resistant alloys: Perhaps the best examples of such alloys are the aluminum and the stainless steel types. In both cases corrosion is inhibited by the presence of protective films, an oxide of aluminum in one case and in the other an oxide film of chromium, both invisible to the eye. Passivity is attributable directly or indirectly to these protective films, even if not of the oxide type.[2]

Arsenates, phosphates, silicates, and chromates form insoluble films with iron at the positively charged electrode (anode) and thus tend to prevent corrosion.[7] It will further be noted that self-stifling reactions are exemplified by insoluble iodide formation at metal surfaces, but that if the product of the reaction is soluble in the liquid medium used, the reaction may even proceed at an increased rate.

The more specific subject of pickling inhibitors, which themselves may be corrosion inhibitors, is taken up in more detail below.

Applications

Surface Preservatives. Slushing compounds or rust preventive materials should remain in place, prevent corrosion, be unreactive toward metal, resistant to oxidation, easy to apply and readily removable without injury to metal surfaces[12]. Perhaps one of the most widely used materials of this kind is lanolin, which is comprised of cholesterol (monohydric alcohol and higher fatty acids 26-27 carbon atoms in length) providing chain-like molecules greater than 50 carbon atoms in length. Reference to Table IV will show that of the materials listed, cholesterol and hydrolecithin possess the greatest area per mol of the chemical types listed.

Compounds of this type are highly polar in type, are readily adsorbed, and can be arranged in a closely packed fashion. Other materials which have found considerable usage for this same purpose are high-molecular weight oxidation products of petroleum such as ketones, keto-acids, esters, alcohols and lactones.

Pickling

Pickling. The acids commonly used in pickling are hydrochloric, sulfuric, nitric, hydrofluoric, phosphoric, and

FIGURE I
NITROGEN CONTAINING INHIBITORS

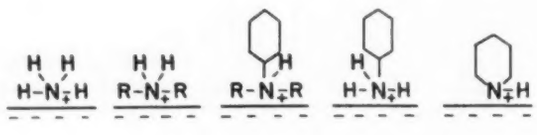
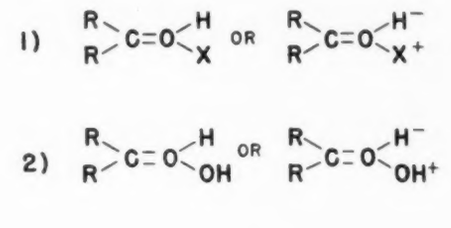
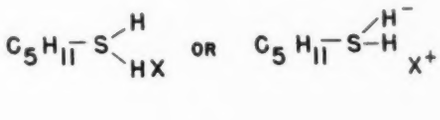


FIGURE II
OXONIUM TYPE INHIBITORS



chromic, or mixtures of these. In some pickling operations combinations of ferrous sulfate with sulfuric and hydrofluoric acids may successfully be used. A recently developed method of pickling is the sodium hydride process, said to be an improvement in many respects over the acid process. The object of the pickling operation is removal of impervious

FIGURE III
SULFONIUM TYPE INHIBITORS



oxide or other film, maintaining the metal in optimum conditions for subsequent processing. It is obvious that unless thorough rinsing is observed, electrolyte salts will be retained on the surface of the metal and may later result in inferior work. Furthermore, the imperfections in the metal surface may effectively prevent complete removal of these salts even under excellent operating conditions.

In most instances it is desired that a minimum amount of metal be displaced in the pickling bath because of dimensional considerations and economy in acid consumption. Ideally it would be desirable that the offending oxide film be removed to the basis-metal and that the solution of metal then immediately cease. These conditions may be approached by adequate control of the bath and especially through the use of inhibitors. It is worth while examining these materials because they exhibit interesting surface characteristics.

Mann[5] developed a theory to explain inhibitor use which is worth repeating. Upon introduction of metal into an electrolyte bath, the metal becomes negatively charged, and positive ions of the metal go into solution. As applied to amines (nitrogen containing organic compounds) it was

(*Continued on page* 333)

"METAL COLORING"

"COLORING OF BRONZE"

By Martin F. Maher and Franklyn J. MacStoker

IN THE April issue of *Metal Finishing* the authors dealt with the formulas and procedures relative to the coloring of brass and brass plated products. In this issue they will be concerned primarily with the coloring of bronze and bronze plated products, inasmuch as the technique and the formulas differ in a greater or lesser degree from that of brass and brass plated wares.

To begin with, brass wares are often polished and buffed to a high degree of smoothness even though some of the gloss is lost in the subsequent dulling operations in coloring and manipulation. But bronze is usually subjected only to acid cleaning and hardwheel polishing or to greaseless compound finishing or sandblasting, prior to the coloring procedure. The surfaces to be colored or stained must be relatively smooth but not necessarily glossed or bright, inasmuch as the subsequent intermediate coloring operations have the tendency to smooth and brighten the product. Before proceeding with the coloring operations it is necessary, of course, to clean all surfaces free of grease, dirt, etc., as in plating operations. Degreasing operations are sometimes necessary. Alkaline cleaning with or without current and light pickling operations or deoxidizing immersion dips are preliminary before immersion in the various coloring solutions. Hence the sequence of operation would be about as follows:

(1) Acid cleaning
(2) Hard wheel polishing, compounding or sandblasting of surfaces
(3) Cleaning for removal of polishing grease and compounds

Coloring Solid Bronze

BROWN:

Immerse with wire, hook or basket, article to be stained or colored.

Solution No. 1:

Ammonium hydrosulfide	¼ to ½ oz.
Water	1 gallon
Temperature	80° to 120° F.

Time of immersion—from 20 seconds to one minute

Move about in solution

Remove and rinse in two waters and follow by scratch brushing, wet or dry, or by wet sand rubbing. This solution's color runs the range between a light brown bronze to a dark chocolate or statuary shade and the operation can be continued with intermediate brushing or sanding until the desired shade is arrived at.

Solution No. 2:

Polysulfide or liquid sulfur	½ oz.
Water	1 gallon
Temperature	80° F.

This solution is for the lighter shades of brown. All ammonium compounds are to be avoided. Proceed as above until color shade is obtained. After drying with warm water and sawdust or by other means, the work can be lacquered with a good hard semi-gloss lacquer or, for outside work or statuary, waxed down with Bees- and Carnauba-wax dissolved in turpentine with burnt umber or brown pigment added.

The foregoing solutions and procedures are the most common of the bronze coloring family and have extensive application to a large variety of products, such as bank and grille work, tablets, ecclesiastical bronzes, etc. This type of work can further be enhanced when bas relief, filigree and casting design permit the use of dry pigmented colors mixed with soft wax, brushed over the recessed parts and stippled until near dry, allowed to set and rubbed with cheesecloth or a dry bristle brush. Soft backgrounds of brown, green, blue and reddish tones can be obtained thereby and provide a further resistance to wear, handling, dampness and humidity.

Bronze Plated Products

In view of the necessity of having to color many products not made of bronze itself but of such basis metals as iron, steel, antimonial lead, etc., a review of procedure and formula for bronze plating is in order. Relatively substantial coatings of a close grained deposit of 0.0003" to 0.0005" is required to stand up in the coloring and intermediate operations. Even room temperature solutions of the common sulphides used in coloring will absorb and reduce the plated coatings of both bronze and brass and the intermediate sanding or pumice operation will take off more. However, much of it is done, and without too much difficulty, when the factors are taken care of. Bronze plating solutions of the standard type of copper and zinc and sodium cyanides, with or without the addition of rochelle salts, are extensively used and successfully, especially when the lighter color sulphide stains are required in the subsequent coloring cycle. How-

ever, the writers prefer the use of a solution wherein cadmium is substituted for zinc, for several reasons. It stands up better in the subsequent coloring operations, especially when the darker or antique stains are called for; is more uniform in color; requires less manipulation and, it is believed, produces a better corrosion resistance on iron and steel products. The formulas of such bronze plating solutions are as follows:

Formula No. 1:

Based on 1% cadmium content, medium color of deposit.

Copper cyanide	30 grams	4 oz.
Cadmium oxide	0.3 "	0.04 oz.
Sodium cyanide	33 "	4.4 "
Sodium carbonate	15 "	2 "
Rochelle salts	15 "	2 "
Water	1 liter	1 gallon

Formula No. 2:

Based on 1.7% cadmium content, light bronze color.

Copper cyanide	30 grams	4 oz.
Cadmium oxide	0.5 "	0.07 oz.
Sodium cyanide	40 "	4.8 "
Sodium carbonate	15 "	2 "
Rochelle salts	20 "	3 "
Water	1 liter	1 gallon

Controls:

Operating temperature	80-90° F.
Current density	8-10 amp./sq. ft.
Voltage	2-3 volts
Anodes	Electrolytic Copper
Free cyanide	½ oz./gal.

Maintenance of Bronze Solutions

As a rule, the anode should supply a substantial amount of the copper metal required in the bath, but not entirely so and, of course, there is a considerable loss from dragout. When copper is needed for replenishment in solution, which fact is determined by regular analysis and the cadmium content is below standard, additions are made of both in proper amounts and balance. If the copper content is right but cadmium is wanting, we build up the latter by the porous cup method of drawing in from a cadmium anode or anodes suspended in the bath, taking care to remove the copper anodes. The porous cup is suspended on the cathode rod, with the current flowing in full from the generator without reduction through the rheostat, for about fifteen minutes or so, or until the desired shade of bronze is obtained, after which the cadmium anodes are removed from solution. Sodium cyanide is added in proportions of one-eighth ounce per gallon per week, for reason of dragout and decomposition of material. Rochelle salt is added occasionally as the need be, which is generally determined by the fact that the anodes coat over with a soft green sludge.

However, for those favoring standard type bronze plating solution for this work, the following formula is included. It is a satisfactory bath.

Formula:

Copper cyanide	4 oz.
Zinc cyanide	½ "
Sodium cyanide	7 "
Sodium carbonate	4 "
Water	1 gallon
Free cyanide	1 oz.
pH	10.5-11

Control Factors:

Operating temperature	90-95° F.
Current density	6-8 amp./sq. ft.
Voltage	1½-2½ volts
Anodes	90% Copper: 10% Zinc

Standard procedure for coloring in sulfide solutions is followed, more or less, after plating in this solution.

Albany and Roman Bronzes

This is another type or class of bronze coloring, not commonly practiced, and reserved for the better grade of products for ornamental use, such as desk sets, bookends, small statuary, lamps and lighting fixtures of the bracket type and medallions, and requires manipulation by experienced operators in coloring procedure, but the colors are not too difficult to produce if certain standards and factors are adhered to. They provide a finish not arrived at by any other means of coloring that the authors are cognizant of. The finish is a deep enamel like effect that seems to permeate the metal surface rather than develop upon it and is clear or mottled and veined, in accord with whether the article is cast, forged, or a stamping or spinning of sheet metal; and will wear well and retain its color with gradual mellowing, without lacquering and with a final waxing and toning operation. The procedure is as follows:

Fine hard wheel polishing and buffing to semi lustre is the first operation for gloss finish or fine sandblast or emery faced wheel for subdued or dull effect. The solutions are somewhat varied in formula due to color scheme desired. The solutions are used hot, 180° to 212° F. For small work, containers or vessels for holding solutions must be of copper, Monel or heavy porcelain lined iron, and heated by gas. Large work tanks should be of Monel with Monel steam coils and temperature control. The parts are placed in the coloring solution on wires, hooks, or in baskets of brass, bronze or copper, and are left there until the desired shade is obtained, which may take from 5 to 20 minutes. Observation by the operator will determine when to remove from coloring bath. The parts come from the solution with little subsequent operation, such as scratchbrushing, sanding or pumicing, required. They usually require only rinsing and hot water drying, after which they can be waxed down with liquid wax with dry color pigments contained therein, to give background and relief effect. They should never be lacquered but could be high lighted, if desired, with sheepskin or canton flannel buffs. The formulas for these coloring solutions follow in sequence:

GREEN SHADES

Copper sulfate	1-2 oz.
Ammonium chloride	1-2 "
Zinc chloride	½-1 "
Acetic acid	¼-½ "
Water	1 gallon
Temperature	180-212° F.

Copper nitrate can be substituted for copper sulfate for the light green shades.

BROWN SHADES

Ammonium chloride	1-2 oz.
Calcium chloride	½-1 "
Copper acetate	¼-½ "
Iron nitrate	½-1 "
Water	1 gallon
Temperature	180-212° F.

Procedure same as for green shades.

Immerse and boil for 5 to 20 minutes. Rinse well and dry in hot water and sawdust, towel or air. Waxing and toning for final operation.

The chemical reactions here are complex and difficult to work out other than in theory. We do know, however, that the iron compounds bring out the brown and the copper compounds the greens, and that the ammonium compounds accelerate the action of the bath.

OLIVE GREEN AND LIGHT BROWN

Copper chloride	8 oz.
Iron perchloride	6 "
Water	1 gallon
Temperature	160-180° F.

Bronze work, buffed or brush effects, will oxidize but brushed effect is more uniform. A green-brown smut is native from solution but on brushing or wet sanding the olive shades develop. Above can be waxed and toned to finish.

HEAVY BROWN SHADES

1.	Copper sulfate	2 oz.
	Nickel sulfate	1½ "
	Sodium thiosulfate	1½ "
	Water	1 gallon
	Temperature	160-180° F.

Will scratch brush, polish or sand blast a pleasant dark brown. Can be waxed and toned with pigment colors.

2.	Aqua Ammonia	½ to 1 pint
	Golden Sulphuret of Antimony	½ oz.
	Water	1 gallon

Use solution warm. Parts will color quickly. The surface of the metal should be scratch brushed then, if a high finish is desired, the oxidized surface can be given a light buffing. This is also an ideal brown oxidize for a sandblasted surface and produces a perfectly uniform brown tone. The article can be lacquered and will give the high finished brown and enamel-like effect and the sandblasted finish a soft matte brown.

Verde Antique and Patina

The verde antique and patina finishes represent the true-antique and weather beaten finishes on bronze and are usually a high grade product, adaptable for articles such as andirons and fireplace sets, antique lighting fixtures, tablets and statuary. They stand up well in and out doors and can be applied over sulfide films or direct to the bronze. The preparatory surface is usually rough ground or sandblasted and the coloring solution is applied with a hand brush and is vigorously stippled almost to dryness after which it is set aside to air dry or placed in an oven with low degree of heat, 110-130° F., till dry and firm. It is then lightly rubbed down with soft wax dissolved in turpentine with a little Damar varnish and vari-colored dry pigments added. Use medium hair brush and cheesecloth for this purpose. Dusting over with dry pigments for antiquing is usually practiced.

MOTTLED GREEN AND BLUE

Copper nitrate	4 oz.
Ammonium chloride	4 "
Calcium chloride	2 "
Copper acetate	1 "
Water	1 gallon

Room temperature. If patina flakes or drags, dilute solution accordingly.

RICH GREEN, BLACK AND YELLOW MOTTLED

Paris Green	3 oz.
Hydrochloric acid	3 "
Potassium chromate	4 "
Acetic acid 56%	1 pint

Mix Paris Green and HCl together and evaporate down to half volume. Make mixture of potassium chromate and acetic acid, add both mixtures together and again evaporate down to half volume. When cooled, brush over product until wet, then stipple well with medium rubberset round brush for few minutes and set aside to dry for one-half to one hour. The article is then ready for waxing and toning. It presents a good hard surface, wears well, does not fade and can be applied to almost any non-ferrous metal.

In conclusion, while some of these formulas and procedures may seemingly be complicated and strange, such is not the case. With practice and some patience reliable and uniform results can be obtained in the commercial production of these finishes.

FILMS AND SURFACE CLEANLINESS

(*Continued from page* 330)

assumed that a salt of the amine would form, which ionized with the positive charge concentrated on the nitrogen atom. The inhibitor then attached itself to cathodic areas of the metal through the N atom as in Figure 1, effectively stifling the reaction. It was theorized that the cross-sectional area of the ion was projected onto the metal and the closeness of packing of the ions in the covering layer would determine the efficiency of the metal covering and whether or not H-ions would penetrate. The same general process was said to be attained by oxygen-containing bodies such as oxonium compounds as in Figure 2 and by sulfonium compounds from mercaptans as in Figure 3. In other words, these are true adsorptions or "Chemisorptions," and to remove these inhibitors if necessary, may require a process other than simple water rinsing. That adsorbed inhibitors may cause more widespread difficulty than is generally recognized is indicated by a report[7] that adsorbed pickling inhibitors caused poor enameling results.

(*To be concluded next month*)

Literature Reference

1. E. H. Lyons, Jr. Trans. Electrochem. Soc., **88**, Reprint 1 (1945).
2. U. R. Evans. "Metallic Corrosion, Passivity and Protection." Edw. Arnold & Co., London (1937).
3. A. W. Hotherstall and R. A. F. Hammond. Trans. Electrochem. Soc., **73**, 449 (1938).
4. W. E. Campbell and U. B. Thomas. Trans. Electrochem. Soc. **76**, 303 (1939).
5. G. L. Clark. "Applied X-Rays." McGraw-Hill Co., Inc., New York (1927).
6. E. A. Gulbransen. Trans. Electrochem. Soc., **83**, 301 (1943).
7. H. P. Munger. Trans. Electrochem. Soc., **69**, 85 (1936).
8. C. A. Mann. Trans. Electrochem. Soc., **69**, 115 (1936).
9. N. K. Adam. "Physics and Chemistry of Surfaces." Clarendon Press, Oxford (1930).
10. G. W. Jernstedt. ASTM Bulletin. #137, pp. 29-35 (1945).
11. J. A. Hendricks. Trans. Electrochem. Soc., **82**, 113 (1942).
12. R. M. Burns and A. E. Schuh. "Protective Coatings for Metals." Reinhold Publishing Corp., New York (1939).
13. O. M. Morgan and J. G. Lankler. Ind. and Eng. Chem., Anal. Ed., **14**, 725 (1942).
14. A. Edeler. Ind. and Eng. Chem., Anal. Ed., **15**, 282 (1943).

All Our Yesterdays

PART IV

By GEORGE SPELVIN

(Continued from METAL FINISHING, April, 1946.)

COAL MINERS GO ON STRIKE. That headline, all too familiar of late, was current in 1906 also, and although it appeared on April 1 it was no joke. It was not until July 13 that an agreement was reached granting the miners an increase in pay and the right of check-off. There were other labor disputes during the year: perhaps the most unusual being a strike of the chorus of the Metropolitan Opera House. But the year is remembered chiefly for the great San Francisco earthquake—pardon, fire. Hundreds were killed and thousands injured, and the property damage reached $300 million. Nature, however, played no favorites: across the Pacific, two severe earthquakes and a flood wrought comparable havoc in Japan.

Even the technical press, which is our main concern, could not completely insulate itself, this time, from the daily news. After May, little notes kept appearing in the magazines of the metal trades reporting the progress of the reconstruction of the San Francisco businesses: ABC company carries on its plating activities in a partially ruined factory with no roof; XYZ company has moved into a new temporary location pending rebuilding, with loss of only two days' production. The stories were of great resourcefulness under the most trying conditions.

The electroplaters, meanwhile, were more interested in the progress of the art; with particular emphasis, as usual upon silver, nickel, zinc and copper plating. A random search through these forty-year-old volumes brings to light items like these:

Workmen removing debris from ruins of Thomas Day Co., San Francisco, following disaster. (Reprinted from Metal Industry, now Metal Finishing, October, 1906).

A gold color solution for plating on steel: this solution is to be added to the regular brass bath and is "claimed by some Down East platers to give good results": dissolve 4 lbs. of sulphate of iron crystals, 4 lbs. sodium bisulphate (powder), 2 lbs. sal ammoniac in 5 gallons of water. Add sufficient cyanide of potash to clear the solution. The solution should be diluted for one-half hour. (*That's what it says.*) 1½ oz. is added to each gallon of brass solution. "This formula is given with due reserve."

A new copper compound is announced for the formulation of copper, bronze and brass baths. It is known as "prepared red copper" and is available as an import from Germany. One journal predicts that it will soon displace all other copper salts for plating because it contains about three times as much copper and therefore less inert matter. In the preparation of the plating bath, it is not necessary to add any ammonia or ammonium compounds, "thus the danger of the formation of oxygen is excluded and one of the most prolific causes of non-adhering deposits, of peeling and blistering, is therefore removed." This journal proceeds to inform its readers that the new compound is cuprous oxide, or red suboxide of copper. But another journal takes issue: "The value of sulphites in a cyanide copper bath has recently been brought to the notice of the plater by the appearance on the market of the red sulphite of copper. This material is the cuprous sulphite and exists in a fine dark red powder. It is not the suboxide of copper as usually believed."

"The dynamo," says an editorial, "is the mainspring of the plating department. It is not so very long ago that almost any machine manufactured by an electrical firm with no particular experience in the plating business was considered satisfactory for plating purposes. This condition of affairs does not longer prevail. It is recognized that the dynamo to be suitable for plating must be constructed in such a manner that it can perform its work properly and must be especially designed for the purpose. Placed, as such machines usually are, in a corner of the plating room and run by attendants unskilled in electrical matters, they have to be primarily constructed with a view of their performing their duty satisfactorily with a minimum of supervision."

America First note: German "sulphuret of potash" is superior to the domestic product and no more expensive. German "red suboxide of copper" is better than the domestic and only half as expensive."

A favorite formula with authors of the day appeared to be, to begin by remarking how surprised they were at the poor practice in many plating shops; this was followed by their prescriptions for its improvement. As an example, "It is a surprise to find out how many silver-platers do their work without having the least idea regarding the thickness of the deposit which they obtain. No matter what the conditions are they plate the work for a certain time and this time is their only guide. As the conditions are not always the same, plating the work for a certain time could not be depended upon. Where meters are used, they can only tell how much metal can be deposited on a surface in a given time. But if a job plater had to figure out the surface of every job he plates every day he would have to spend all his time figuring instead of plating." The

recipe for improvement is the use of a sample piece, plated along with the work and stripped for testing.

There wasn't any OPA in 1906, and metal prices changed with a frequency that must have been welcome to speculators but rather disconcerting to the average business man. You might be interested in these prices, culled from the April and November, 1906, issues of *Metal Industry*.

	April	*November*
Copper	18.75c	22.50c
Tin	38.25c	43.00c
Lead	5.45c	6.00c
Aluminum	38c	41c
Nickel	45-50c	50-60c
Magnesium	$1.50	$1.50
Cadmium	95c	$1.80

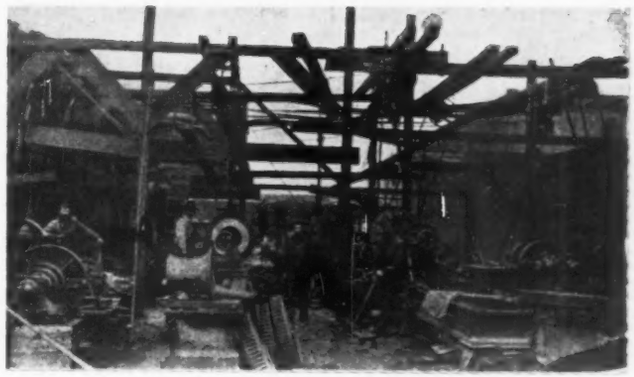
Speculating on the cadmium market must have been fun.

A letter to the editor, from a well-known plater, tells its own story: "Like the old adage that the nearest way through is not always the shortest way home, so cheap information is sometimes a dear investment." There called on the writer a plater who was suffering from the consequences of misapplied information. His nickel solution did not plate as white as he thought it ought to, so he consulted a friend who was a polisher in a large concern known for its production of nickel-plated articles. The polisher said that in his factory the foreman plater used sulphuric acid to make the solution plate white. "Acting on this information the plater commenced to add sulphuric acid to his bath—of course in unknown quantities. Many platers will recognize the result: which was of course no deposit and only a very copious evolution of hydrogen." The hapless victim however continued pouring in acid and at last realizing he had gone too far resorted to the usual neutralizer: ammonia. He tested the solution with litmus, but the results were very unsatisfactory: the deposit was not adherent, the color was "any old thing from a dirty black to a variegated antique brass effect."

The plater wasn't out of friends though. Another showed him an article on boracic acid for the production of white nickel deposits. Things couldn't be any worse so he added some, but our correspondent reports that it did no good.

Then the writer of the letter was called in. Sizing up the situation, he says, he realized that there was entirely too much free ammonium sulfate and borate present, and there was only a slim hope of saving the bath: he recommended the addition of common salt, and if this were not successful the solution should be thrown out. But it worked—and the solution plated "very freely" on account of the unusually good conductivity.

This communication was considered of such importance by the editors that they appended an editorial comment of their own: "Every plater should read over and take to heart the letter in this issue. Every plater should realize what a sensitive thing the plating bath is and how quickly it can be spoiled or improved by comparatively small additions of various substances. There are still many among the plating fraternity who do not seem to realize what effect the addition of small quantities of reagents, and especially of acids and alkalies, has upon chemical and particularly upon electrochemical reactions." The proper way, of course, is to experiment, preferably upon small samples of solution and proceed slowly.



Production continues, minus roof, at Murray Bros. Machine Shop, San Francisco. (Reprinted from Metal Industry, October, 1906).

The controversy over hot-dip vs. electrogalvanized zinc coatings, already noted in previous articles of this series, continued unabated. One correspondent averred that without any doubt whatever hot-dipped coatings were immeasurably superior: outdoor exposures showed that electroplated samples rusted while hot-dipped were good as new after three years. But he failed to tell anything about the comparative thicknesses of the two sets of samples.

In the same connection we may note an article entitled "A Practical Cold Galvanizing Solution" which attempts to debunk some of the patented and secret processes. "Many patents have been issued," the author states, "based upon formulas composed of the common zinc salts and depending entirely upon the addition of some organic substances to play the most important part in the specifications. This was done in order to make the organic substances appear of some intrinsic value to the validity of such patents. I for one cannot realize the ground upon which such validity is claimed, as the solutions are composed entirely of commercial articles and the method is the same as applied in the production of a number of commercial electrodeposits. However that may be the owners of such patents seem to guard them with jealous care and to surround them with much mystery."

Which calls to mind that the French said it thus: plus ca change, plus c'est le meme chose.

That motto is not of universal validity, though, as the next item will show. It is called "Lessons of the Automobile Show," and it has this to say: "We cannot say that the plater plays a very important part in automobile construction, although it was noticed that many of the higher-priced cars were equipped with silver-plated accessories. Whether the plater will be a factor in this industry depends on whether electroplated accessories will become a fad."

The editors' crystal ball was clouded in 1906, for we also find this: "Electroplating with cadmium seems to be relatively new to the trade. A solution of cadmium carbonate in cyanide of potassium is best for this work, but as far as the use of cadmium deposit is concerned, it cannot be said that it will fill any want."

Helpful little hints and notes to platers were used to fill up columns forty years ago, in much the same way that a small-town newspaper uses items about the home life of the Fiji Islanders. Here are a few: Two or three ounces of commercial sulphuric acid in 100 gallons of a nickel solution will sometimes work wonders in bringing up a good clean white deposit . . . When a plater is accustomed to use

brightening agents in the silver bath in the form of carbon bisulfide in potassium cyanide, he might try benzol in place of it. This dissolves more easily and gives the same results; and it will stay in the solution without falling to the bottom . . . If the internal resistance of a nickel solution is high with poor conductivity, ½ oz. of sal ammoniac and ½ oz. of borassic (*sic*) acid to each gallon will improve it. The borassic acid should be dissolved separately in boiling water . . . Butter of antimony is used in a number of dips and electroplating solutions. It takes its name from the fact that when concentrated and cold it resembles, to a certain extent, ordinary butter. (*What do you mean, ordinary?*) It is the pentachloride. (*Guess again*) . . . It is an error to allow foreign matter to accumulate upon the surface of anodes. Many a plater has doctored his solution when in reality all that was needed was to scrape off his anodes. Slime and films are insulators . . . Thin deposits of brass and copper on spelter often disappear on standing: they are completely absorbed by the zinc . . . It is preferable to purchase crystalline chemicals rather than powdered ones, since the latter are more easily adulterated by unscrupulous merchants. All powders look more or less alike, but crystals have distinctive forms . . . In spite of more or less opposition among many of the non-progressive nickel-platers, the use of boracic acid (also called boric acid) in a nickel bath has by now become standard. The patent to Weston, number 211,071 of December 17, 1878, has now expired and all are free to use it . . . Don't let work that drops to the bottom of the plating tank accumulate there: It dissolves slowly and contaminates the bath.

It has been noted by many writers that the tone of the scientific and technical press forty years ago was somewhat less polite than today: polemics were really polemics then, and occasionally even the most sedate journals seemed to borrow some of the atmosphere of the Brooklyn ball park during a Sunday double-header. *A letter to the editor:* "I thank you very much for the formula for bright silver paint, but which I am sorry to say is n.g. After spending several dollars upon this thing (that formula) I gave it up as a bad job. First place metallic silver no good, second place powdered glass no good, third place whole formula no good. I believe that if a man gives a formula he should be sure of the success of the same before doing so." *Editor's reply:* "The Zulus have a proverb, hambla gechla, which in the vernacular means go slow. This has two applications: some men go slow because they are too densely ignorant to go any other way; other men go slow because their wisdom teaches them it is often desirable to do so. Before registering a kick it is always wise to take thought of two things: first, where the kick is going to land and second, the accuracy and justice of the kick itself. That paint can be used upon everything of an earthenware or glass nature except pure white glass. But in using the formula some little knowledge is required to get results, especially in the firing process."

As usual, no survey of the plating magazines would be complete without a glance at the question and answer—should we call it the agony?—column. Q.: How can I electroplate manganese? A.: You can't. Manganese dioxide deposits on the anode and nothing deposits on the cathode. Anyway a deposit of manganese would be of no value. It rusts as readily as iron and its color is not beautiful. We fail to understand what you will gain by the use of a manganese deposit even if you could obtain it.

Q.: I have trouble with a silver chloride-potassium cyanide bath. It plates all right but very slowly, the anodes are dirty and the iron wire holding the anodes is attacked. A.: Your solution contains excess potassium carbonate. Hydrocyanic acid is the only remedy: add ½ oz. commercial HCN per gallon: Use extreme caution!

Q.: Can you give me a satisfactory cyanide nickel solution? A.: There is no satisfactory cyanide nickel solution. (That one seems to come up every so often.)

Q.: How can I remove arsenic from a brass solution which is plating gray? A.: There is no remedy except to work it out.

Q.: Please let me know in what kind of a vessel I can put that solution for depositing on glass, described in your last issue. A.: A granite basin is probably best. A coating will form on most any vessel and has to be removed. (Thought he had them there!)

Q.: Would you please give me formulas for nickel, copper, brass and bronze solutions. A.: You are asking too much in one question. (Even an editor has some rights, it seems.)

And a quick look at the classified advertisements brings forth this: WANTED. Polishers and buffers, $2.50 per 9-hour day. (I can't think of an appropriate comment for this one.)

A letter to the editor praises "Harmony Between the Solution and the Current": "If the solution is too strong for the current the result is that deposition is slow, hard and crystalline. If you have a strong solution and a weak current the result is bound to be bad. The law of copper deposition is that if you have a strong solution you must use a strong current and if a weak solution use a weak current. In other words the solution and the current must be equal and one must not overcome the other."

An editor goes out on a limb: "Were potassium cyanide cut off the market, electroplating would almost pass out of existence. Best results are given by cyanide solutions. Even in the case of nickel this is true: the only reason nickel cyanide solutions are not used is that the anodes do not dissolve."

A story about "Electrogalvanizing and William Penn" remarks that when the statue of William Penn, surmounting the city hall in Philadelphia, was cast, "it was decided that an aluminum deposit would form the best protection and at the same time render it a thing of beauty." No one knew how to plate with aluminum, but a firm accepted the contract; the solution they used was "unknown, but is certain to have contained zinc salts, as well as aluminum salts. The use of aluminum in zinc baths has become common."

Dr. Bancroft's early papers on the Chemistry of Electroplating were still being abstracted and discussed in the journals. Appearing originally in the Transactions of the American Electrochemical Society, these papers still make good reading, for their combination of breezy style and good sense; they must have impressed contemporaries in the same way, for editors quoted liberally. For instance, in connection with the subject of adhesion (or adherence, as it was then called): "No one seems to have been struck by the absurdity of the statement, to be found in most books on plating, that nickel cannot be plated on nickel because

(*Concluded on page* 339)

ELECTROPLATING OF

ALUMINUM AND ITS ALLOYS

By MITCHELL RASKIN

Rainbo Processing Co., Los Angeles, Calif.

ELECTROPLATING of aluminum and its alloys has created a lively post-war interest in plating and manufacturing circles. Electroplating of aluminum portends to play an important part in the plating shop since the increase in use of aluminum and its alloys (other than aircraft) during the coming years is expected to be very substantial. The excellent workability, castibility, and low density of aluminum makes it an ideal metal for a multitude of consumer goods.

The greatest incentive for electroplating aluminum is to improve its appearance. Although aluminum can be made attractive with a polishing lathe, and a myriad of effects can be obtained with various etchants and color anodizing, the buying public still favors the familiar metallic finishes of copper, brass, chromium, silver and gold, and the various "oxide" effects. It is now possible to take advantage of the excellent properties of aluminum and its alloys and also satisfy the aesthetic tastes of the consuming public. Among other reasons for electroplating aluminum is to improve its abrasion resistance, or wear, to facilitate soft solder joining, to improve electrical contacts and to permit direct rubber bonding.

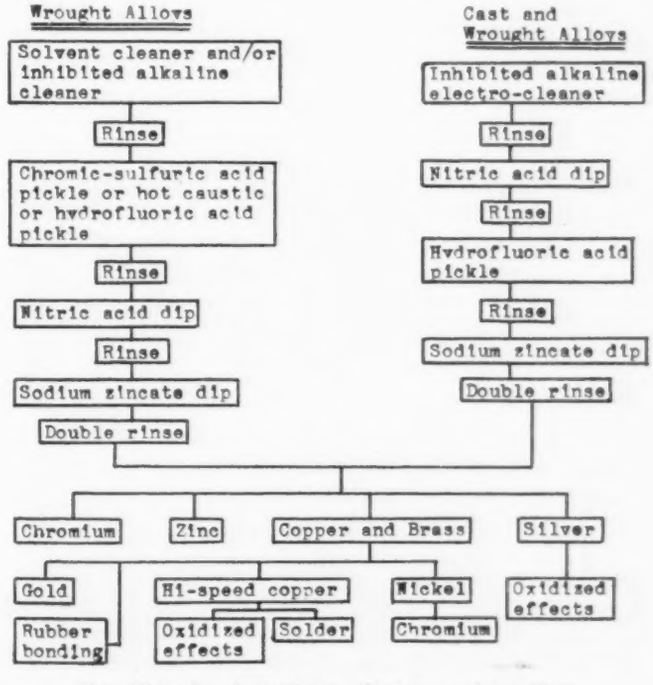
In general most electrodeposits form a cathodic couple to the aluminum and therefore decrease corrosion resistance, and hence, use of electroplated aluminum for exterior applications or in humid atmospheres is not recommended. However, some aluminum alloys may be electrolytically protected by zinc or cadmium (anodic to the aluminum alloy) under certain service conditions such as salt atmosphere. Direct chromium deposits offer some protection to aluminum in an alkaline medium.

Aluminum and its alloys cannot be satisfactorily electroplated by ordinary techniques used for other metals. When conventional electroplating methods are employed, the deposit usually has poor adhesion and suffers from blisters and scaling. These defects are attributed to several factors, principally the ever-present ready-forming aluminum oxide film. Early methods of plating aluminum removed this oxide by means of sandblasting and/or several dips in alkaline and strong acid solutions, followed by dipping in acid solutions of iron, manganese or nickel. Since aluminum is less noble than these metals, it will replace them in solutions of their salts. In one process iron was electroplated directly on the roughened, clean aluminum surface. These processes required or inadvertently resulted in rough-etched surfaces and the adhesion of the deposition depended primarily on a mechanical or keying action.

One approach in solving the oxide and roughness obstacles was to accept the inevitable oxide and to put it to advantage by controlling its character and density. This was accomplished by electrochemical anodizing. The Aluminum Company process employs phosphoric acid and the Krome-Alume process (U.S. Patent 1,971,761), employs oxalic acid as the electrolyte in their respective anodic processes for electroplating of aluminum. The writer has had no experience with these anodic processes and no contact with anyone using them.

The problem of oxide removal and surface etching was solved by a process which replaces the oxide film with an adherent metallic coating. This development is known as the zinc immersion process and appears to be simpler, less expensive, and more versatile than the anodic processes.

The zinc immersion process employs the same principle of metal replacement as the metal acid processes, but it differs from the acid process in that a strongly alkaline



Flow Chart for electroplating aluminum and its alloys.

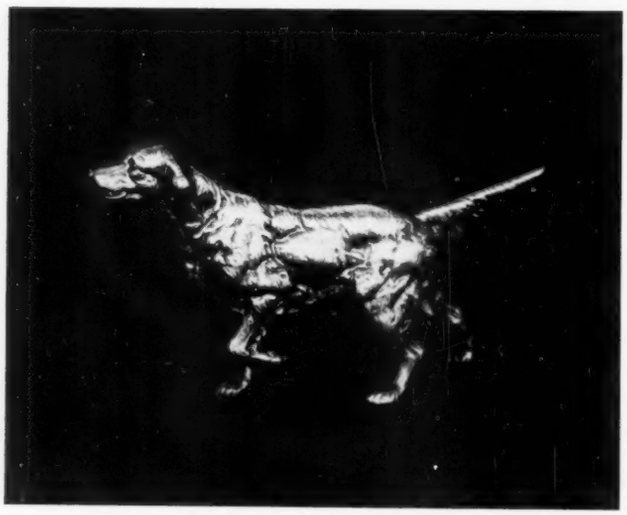
solution is used, the solution consisting of sodium zincate (Na_2ZnO_2) in caustic soda. After proper pre-treatment the article is immersed in the zincate solution. The result is continuous deposit of zinc which is not dependent upon a mechanical keying action for adhesion, but a very adherent inter-atomic bond. Although the solution is highly caustic, the aluminum surface is not attacked to any extent. This is due to the rapid forming of the zinc film which inhibits further attack of the caustic solution. The process may be described as self arresting.

Racking

Aluminum racks, hooks and wiring are preferred since it is believed that copper might produce an electrolytic effect in the zinc immersion solutions which would prevent formation of a satisfactory zinc film and result in local blistering during subsequent plating operations. Some of the solutions used in the process will also attack copper. However, in spite of these warnings, the use of copper wire and hooks has been employed with only minor injurious effects. When aluminum is used for racks, the plating deposits, with the exception of chromium, may be removed from the racks by means of concentrated nitric acid. Chromium can be satisfactorily removed by anodic stripping in a 15% (by weight) solution of sulfuric acid. This treatment produces an oxide film upon the aluminum surface which is removed by a light etch in a caustic soda solution.

To state adequate and proper cleaning is necessary prior to electroplating aluminum is to reiterate an oft repeated plating axiom. Yet again it must be re-emphasized since approximately 90% of all zinc immersion aluminum plating defects is a result of inadequate or improper pre-treatment. The importance of surface preparation was demonstrated by the fact that a polished aluminum surface was more readily electroplated than an "as rolled" or "as cast" surface. This indicated that surface impurities or contaminants such as oxides and dirt were imbedded in the surface from rolling or casting operations.

Cleaning procedures have been developed which remove imbedded impurities with a minimum of surface roughening.



Electroplated aluminum casting—Statue of Dog.

Cleaning

Oil or grease should be removed in a vapor degreasing machine or by similar solvent cleaning methods. An inhibited alkaline aluminum cleaner operated hot (170° F.) may be used to remove superficial dirt. The work, acting as cathode, may be cleaned electrolytically in the same solution. Approximately 20 amperes per square foot is applied for 10 to 15 seconds. Electrocleaning is especially recommended for castings.

After surface dirt has been removed, one of several etchants may be used to remove a thin layer of metal together with imbedded impurities. A satisfactory etchant for wrought alloys is a mixture of chromic acid and sulphuric acid in the following proportions:

Chromic acid	4.7 oz./gal.
Sulfuric acid	24 "

For 61S alloy add ⅔ fluid oz./gal. of commercial grade (48%) hydrofluoric acid. This solution is operated at a temperature of 150° F. and the time of immersion is from one to five minutes. The danger of surface roughening is less when this solution is used. However, the disadvantages are that a lead or synthetic lined container must be used together with heat and with an adequate exhaust system, since the fumes are a serious health hazard.

Castings (and wrought alloys) after electrocleaning, should be given a five-second dip in a mixed acid solution, consisting of three parts commercial nitric acid and one part commercial hydrofluoric acid, or individual dips—first in full strength nitric acid followed by a dip in 10% (by weight) commercial hydrofluoric acid.

A ten-second dip in a solution of concentrated commercial nitric acid at room temperature is a necessity for parts previously immersed in the caustic solutions in order to remove the precipitate formed. This dip is also recommended for use after the chromic-sulphuric acid mixture in order to insure no copper contamination on parts prior to zinc immersion. For this reason this nitric acid dip should not be used for stripping.

Zincate Dip

Following the nitric acid dip, the work is immersed in the zincate solution operated at room temperature. The zinc immersion solution consists of mixture of 100 g./L (10.4 oz./gal.) of zinc oxide and 350 g./L (70.4 oz./gal.) of caustic soda. The range of concentration of the caustic is not critical, satisfactory results having been obtained with concentrations varying from 300 to 600 grams per liter. Extra fine zinc oxide powder will not wet satisfactorily and should not be used. Commercial grades of zinc oxide which have copper or other impurities must be avoided. The sodium zincate drops to the bottom of the container and must be stirred occasionally to be kept in suspension. Parts receiving a satisfactory zinc treatment have a uniform gray coating. Occasional light streaks apparently do not interfere with subsequent plating. If the parts have a black precipitate along the edges, it may indicate lack of zinc in solution, caused by infrequent stirring, or the need of zinc oxide additions. Generally, the replacement of "drag-out" losses by additions of the proper materials will keep the solution "sweet" for a long period. The specific gravity of the solution may be used as a guide to determine when additions should be made. Some operators have experienced better adhesion of de-

posits on copper-aluminum alloys (wrought or cast) by using zinc sulphate in place of zinc oxide (354 g./L $ZnSO_4$. $7H_2O$).

The zinc film is very thin and adherent. The coatings on 3S alloy are approximately 0.3 milligrams per square inch (0.0000026") in two minutes immersion time.

Rinsing after each operation is, of course, taken for granted. However, special attention must be given to rinsing after the zinc immersion. The zinc solution, being very viscous, has a tendency to cling to the parts. It is necessary to use a double rinse in order to remove all traces of the zinc solution. A combination of dip and spray or two dips may be used and a continuous overflow should be provided in both rinses.

Plating

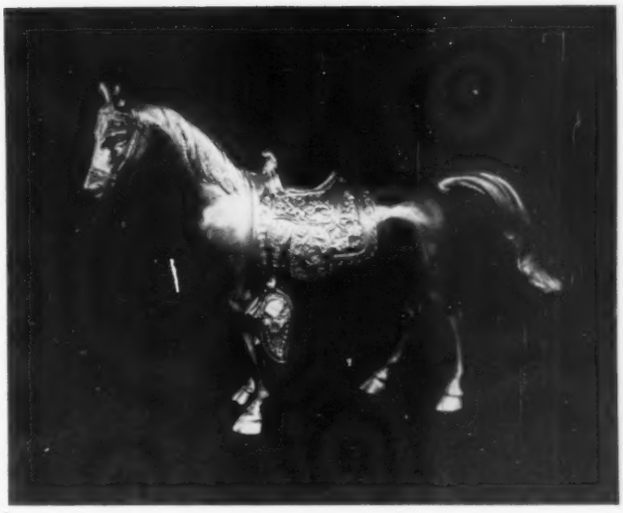
Any electrodeposit which can be successfully plated upon zinc can be used directly on the zinc coated aluminum. The only exception is a plating treatment which penetrates the thin zinc layer and attacks the underlying aluminum.

Tests have shown that the strength of the electrodeposit bond is greater than that of parent metal. Attempts to remove the plate have resulted in failure in the basis metal, indicating that the bond is inter-atomic rather than mechanical.

Rochelle copper cyanide solution operated at room temperature is the recommended copper plating solution for a general strike coat. Electrical contact should be made quickly and a current density as high as 30 amp./sq. ft. may be used for rapid coverage. Thirty seconds is all that is generally necessary for a strike coat. If a heavier coat is desired, the current should be reduced to approximately 10 amperes per square foot and plating continued for several minutes. For a rapid and bright copper coating any of the popular proprietary rapid plating solutions may be used following the Rochelle copper strike. After the work has a deposit of copper any electrodeposit which can be applied on copper may be employed.

Brass can be applied directly on the zinc surface from a standard plating solution operated at room temperature. The brass plate can be satisfactorily used as a strike coat prior to other electrodeposits.

Nickel, plated from solutions designed for plating on zinc, may be used directly on the zinc immersion coat or the nickel may be plated over a Rochelle copper strike.



Electroplated aluminum casting—Statue of Horse.

Silver may be plated directly upon the zinc immersion surface providing the same procedure used for steel is followed. Electrical contact should be made, if possible, before work is immersed in the plating solutions.

Chromium can be plated on the nickel deposit in the same manner as employed on steel. The Aluminum Company of America suggests the following procedure for applying chromium directly on the zinc coating: "Plate from a standard chromium solution at 65°-70° F. After applying a preliminary deposit at this low temperature, plating can be continued at high temperature (130° F.), thereby producing heavy and hard deposits. The transition from low to high temperature plating may be accomplished by heating the chromium solution after deposition has been started at the lower temperature, or the work can be transferred without rinsing from a cold to a high temperature bath. It must be held in the high temperature solution without current until it has reached the temperature of the bath. Plating is then started at one ampere per square inch. For some applications a 10-15 minute deposit at the low temperature is sufficient. The deposit so produced is slate gray, but may be buffed to a metallic luster with special chromium buffing compounds."

ALL OUR YESTERDAYS

(*Concluded from page* 336)

it will not adhere. If this were true it would be impossible to deposit more than an infinitesimally thin film of nickel electrolytically. What people mean is that an 'active' nickel containing hydrogen will not adhere to a 'passive' nickel. There is nothing surprising or mysterious about this."

Before taking leave of 1906 we should recommend to our readers two papers in the Transactions of the American Electrochemical Society, Volume 9. The early history of chromium plating, in the days before its commercial success, is glimpsed in a paper by M. Le Blanc. This paper also illustrates what was said earlier: that polemics were really polemical in those days. On another page appears a paper by Dr. Isaac Adams, the "father of nickel-plating," which recalls his early experiences in "The Development of the Nickel Plating Industry." This paper, and the discussion which follows it, are too packed with gems to permit of abstracting in an article like this one: we can only urge the reader to see for himself.

To round out the story, we need only note that those were the days of Anthony Comstock, who in August raided the Art Students' League in search of immodest art; but most of the news continued to emanate from the White House and its dynamic occupant, TR. He orders the public printer to use the new simplified spelling in all public documents (later rescinded); he leaves for Panama and becomes the first President to travel outside the country's borders during his term of office; he wields the "big stick" as several major anti-trust suits are begun by the government; and towards the close of the year he is awarded the Nobel Peace Prize for his efforts in bringing to an end the Russo-Japanese war.

Time marches on—to 1907.

The Effect of Various Surface Treatments in Cleaning and Preparing Copper, Nickel and Steel for Chromium Plating

By William M. Tucker* and Robert L. Flint**

Introduction

THE reluctance of certain cathode surfaces to accept a chromium deposit has been a recognized problem from the time chromium plating first became a commercial reality. That the problem has been both important and interesting is attested to by the frequent references made thereto in the literature. Specifically, Pierce[1] in 1928 referred to surface preparation by anodic treatment at low current density in a chromium plating bath to remove the oxide film, to quote, "It (the cathode surface) apparently reaches a condition of equal passivity or uniformity over its whole surface." Haring and Barrows[2] observed that the plating bath formulation and operating conditions did not alone determine the plating range. They reported that the cathode metal exercised a marked effect upon the plating range. This effect was more pronounced at the top limit than it was at the lower limit of the bright plating range. Both steel and nickel cathodes yielded significantly narrower bright plating ranges than did copper. They concluded that the effect was attributable to a low hydrogen overvoltage. Haring cautioned against immerison of the work in the chromium plating bath prior to application of current. This was cited as being particularly poor practice for both iron and nickel. Reference was made to anodic treatment in the chromium plating bath as being beneficial for both iron and nickel. Lukens[3] reported upon the activation of "passive" nickel plate produced by depositing nickel upon graphited wax molds. His means of activation were immersion in acidulated hypochlorites, chlorine water and acidulated iodine dissolved in potassium iodide. In the discussion of the Lukens paper Blum called attention to the oxidizing properties of the activating agents used and suggested that an organic film rather than an oxide layer had been destroyed. He stated flatly that passive nickel could be activated by halogen ions only. Lukens also called attention to the necessity of activating both steel and nickel prior to chromium plating to minimize the formation of trivalent chromium which came about because of the customarily excessive currents required to cover both steel and nickel with chromium. Cuthbertson[4] reported essentially the same difficulties as did Haring and Barrows and Lukens. He attributed the trouble experienced in satisfactorily plating nickel with chromium to a low hydrogen overvoltage, an unclean surface and a tendency for the surface to passivate in the chromium bath. It was proposed that both nickel and steel be struck over with a thin plate of copper to facilitate their coverage with chromium.

These early investigators all recommended that copper be used as an undercoat for chromium because it covered easily, presumably because of a high hydrogen overvoltage, thereby allowing the chromium plating bath to be operated under conditions favoring a minimum of trivalent chromium formation. Most investigators consequently favored copper test pieces in their researches. However, Schneidewind[5] in 1928 did utilize test specimens of copper, nickel and steel and recommended that, in addition to removing all dirt and grease, the copper be processed in cyanide solution and that both nickel and steel be pickled in acid to remove oxide films prior to chromium plating. No exact processing conditions were given. Similar references to oxide removal were made in books by Blum and Hogaboom[6] and by the Machinery Publishing Company, Ltd.[7] To summarize the teachings of the literature, it can be said that it was an observed fact that copper, nickel and steel varied in their ability to accept chromium plating. This variation was thought to be due largely to the presence of oxide films which caused variations in the hydrogen overvoltage. A prevailing opinion existed to the effect that high hydrogen overvoltage favored coverage with chromium. Experimenters had utilized means for removing oxide films from the three common metals, copper, nickel and steel, but generally evaded the exact details of the processing, suggesting, as did their reported results, the possibility that the processes utilized were not always completely effective.

As is often the case where a problem confronts a considerable number of practical operators, the exact evolution of a means of solving the problem frequently is buried in some obscurity. At any rate the recognition of the disadvantages of copper and copper alloys as basis metals for chromium deposits led ultimately to the now common practice of depositing chromium upon both buffed and bright nickel deposits. At some time in the earlier portion of the decade 1930-1940 preparation of nickel deposits for chromium plating by immersion in strong solutions of commercial hydrochloric acid became a general practice. Further, partly as a result of Hothersall's[8] work on the adhesion of nickel to nickel, both immersion and cathodic processing of nickel in sulfuric acid came into more common use.

With the coming of the war and the immense development in the utilization of chromium to combat wear, there were developed means for properly preparing all types of steel. At the same time there came about a better understanding of the effectiveness of these methods. The commonly accepted preparatory technics developed were for nickel and high-nickel alloys, up to several minutes immerison in approximately 6 *N* HCl (1:1 by volume) and for most steels, anodic etching in the chromium plating bath or

* Chemist, Eastman Kodak Company, Rochester, N. Y.
** Formerly Junior Chemist, Eastman Kodak Company.
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a similar formulation, and in some cases anodic etching in sulfuric acid. A thorough understanding of these methods commonly used in the process of preparing surfaces for "hard chromium plating" may be had by studying the data presented thereon by Dubpernell,[9] Logozzo,[10] and Kolodney.[11] The above developments generally refer to preparation of surfaces for the receiving of heavy deposits of chromium. Harshaw and Long[12] refer to an alkaline cathodic process for treatment of a filmed bright nickel deposit prior to decorative chromium plating. Several of the above-listed authors have recommended cathodic cleaning particularly for nickel surfaces.

A review of the literature indicates that, although practical methods had been developed for obviating the tendency for copper, nickel and steel to be difficult to chromium plate uniformly and easily, the situation as a whole had apparently never been investigated quantitatively, possibly because of the lack of an adequate means for measuring the effects with a reasonable expenditure of labor. It was, therefore, the purpose of this investigation to study these effects quantitatively with a device known as the Hull cell.[13, 14]

Experimental

Fig. 1 reveals the details of the particular Hull cell used in our experiments. The cell was constructed by the Corning Glass Works of 0.13 in. (3.2 mm.) thick Pyrex glass and was designed to accommodate a cathode plate 4 in. (102 mm.) long by 2.5 in. (64 mm.) high, also an anode 2.4 in. (60 mm.) long by 2.5 in. (64 mm.) high. The working depth, when the cell contained 267 ml. of solution, was 2 in. (51 mm.). The cathode area was, therefore, 8 sq. in. (52 cm.^{2}) and the anode area 4.75 sq. in. (31 cm.^{2}). The average current density on the anode was 303 amp./sq. ft. (33.6 amp./dm.^{2}). The current density on the cathode was variable. The MacIntyre and Hull[14] general equation, $A = C\,(27.7 - 48.7 \log L)$ was used, in which A is the current density (amp./sq. ft.) at the selected point; C is the total current applied to the cell (10 amp.), and L is the distance in inches of the selected point from the high current density end of the plate. Calculating the current density relations portrayed by the test plate with this equation, the dotted line curve of Fig. 4 was obtained. The current density ranges indicated by this curve seemed higher than those experienced in commercial practice. Accordingly, it was decided to re-evaluate the current density range curve by weighing the deposit of chromium on individual sections of the plate and from this result and from the Dubpernell[9] efficiency *vs.* current density data plotted in Fig. 3, calculate the effective average current density (amp./sq. ft.) for each segment of the test plate. Fig. 2 and Table I summarize the experimental data obtained. The solid curve of Fig. 4 resulted when the above procedure was followed. An inspection of the plotted data indicated that values read between $L = 0.25$ in. and $L = 3.25$ in. were probably reasonably accurate. Further, the maximum indicated current density falling in this range of L was 475 amp./sq. ft. (51 amp./dm.^{2}) instead of 570 amp./sq. ft. (61.25 amp./dm.^{2}), a value much nearer that experienced in commercial chromium plating.

Anode. In the early phases of this investigation unpredictable changes in current density occurred during the 5-minute plating cycle. These changes were finally traced to the use of chemically pure lead as an anode. Apparently the average anode current density of 303 amp./sq. ft. (33.6 amp./dm.^{2}) was causing an anode phenomenon not normally experienced. This difficulty was overcome by substituting a platinum anode, a satisfactory step in this

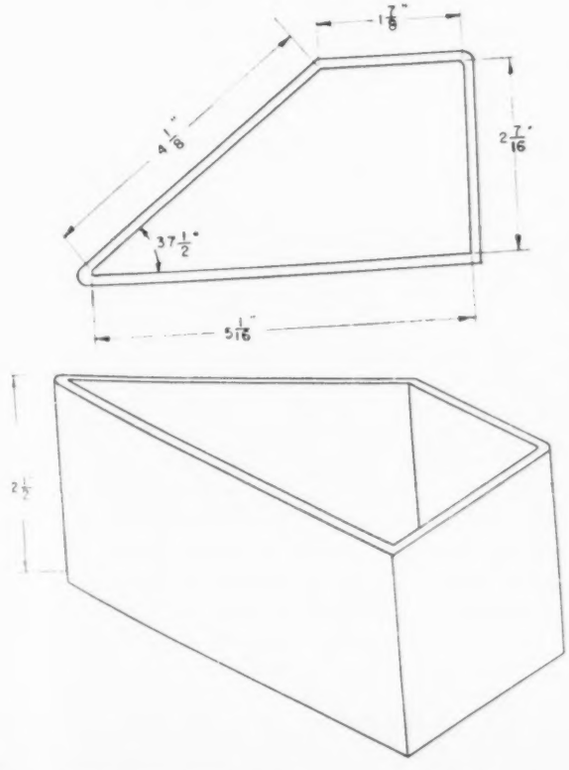


Fig. 1. Pyrex glass Hull cell. Inside dimensions: ⅛ in. wall thickness; working depth, 2 in.; capacity, 267 ml.

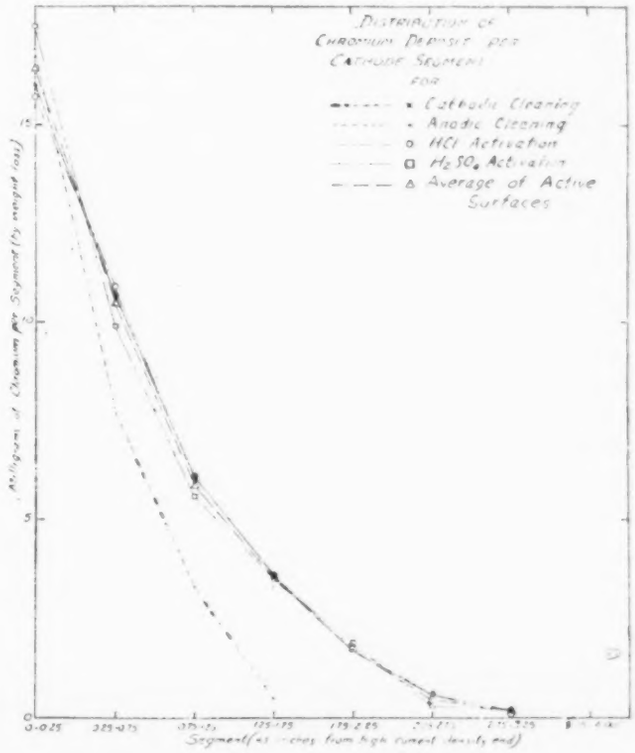


Fig. 2. Distribution of chromium deposit per cathode segment.

TABLE I

Efficiency of Chromium Deposition on Differently Processed Buffed Nickel Specimens

Plating bath: 400 g./L. CrO_3, 4 g./L. SO_4 ion.
Hull cell conditions: Temperature, 45° ± 0.5° C.; current, 10 amp.; time, 5 min.

Method of Processing	*Actual Ampere-Hours*	*Mg. of Chromium Deposition**	*Efficiency of Chromium Deposition**	*Hull Cell Ranges in Amperes per Square Foot*				
				No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
Anodic cleaning alkaline solution	0.828	29.6	11.3%	0-158	.....	.....	158-232	232-475
Cathodic cleaning alkaline solution	0.831	38.9	14.5%	0-20	20-50	.....	50-225	225-475
15 seconds immersion 5.8 *N* HCl	0.864	38.5	13.8%	0-20	20-27	.....	27-475	
2 minutes immersion 5.8 *N* H_2SO_4	0.859	39.8	14.3%	0-20	20-27	.....	27-475	

* This was the overall efficiency of deposition and was determined by comparing the total weight of chromium deposited with the weight of deposit of copper obtained when a copper sulfate coulometer of thefollowing composition: $CuSO_4.5H_2O$ = 150 g./L, H_2SO_4 = 60 g./L and C_2H_5OH = 50 ml./L was operated in series with the Hull cell. The coulometer current density was 1 amp./dm.^{2} and the coulometer temperature was 20° to 25° C.

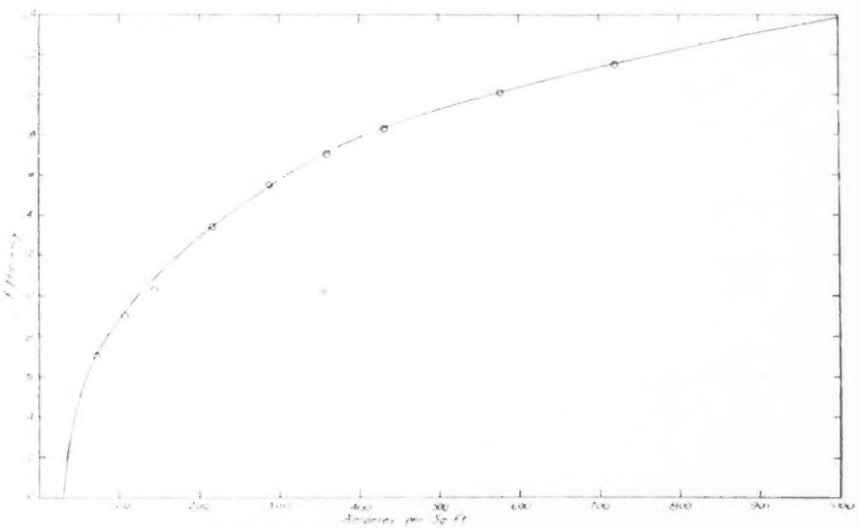


Fig. 3. Efficiency vs. current density. 400 g./L CrO_3; 4 g./L SO_4 ion. From Dubpernell, "Modern Electroplating." Table III, p. 123. (Note 45° C data.)

case because no 267 ml. portion of electrolyte was ever used a second time.

Cathode. The cathodes used were each originally 4 in. x 2.5 in. (102 x 64 mm.) in size and 0.025 in. (0.6 mm.) thick. The basis metal was quarter hard cold rolled SAE 1010 steel* of selected surface. All cathodes were buffed, prior to any subsequent operations, using a folded disc type of muslin buff dressed with a buffing compound of the semi-greaseless type containing levigated alumina abrasive. As a matter of record all buffing was conducted with the same wheel, compound and operator. A careful temperature check made by taping a thermocouple joint to the back side of several plates indicated that a maximum temperature of 230° C resulted when buffing the steel plates. Generally, a lesser temperature (200° C maximum) resulted when buffing the nickel- and copper-plated test plates. This temperature was not deemed excessive in any case. The test plates to be copper plated were struck over with about 0.0002 in. (5 microns) of copper deposited from a Rochelle salt type cyanide copper bath and then plated with 0.002 in. (0.05 mm.) of copper from a conventional acid type bath containing molasses as an addition agent. The test plates to be nickel plated were coated directly with a minimum of 0.002 in. (0.05 mm.) of gray nickel from a Watt's type nickel bath. Both the copper-plated and nickel-plated cathodes were buffed as described above. No effort was made to buff any of the plates immediately prior to use.

Chromium Plating Bath. The 400 g./L chromic acid plating bath was selected for this study primarily because the investigators had utilized it more and partly because decorative chromium plating more often was conducted in this chromic acid concentration bath. Except as indicated, the ratio[9] of chromic acid anhydride (CrO_3) to sulfate ion was 100:1. The chromic acid used in this investigation analyzed as follows:

CrO_3	99.7%
Cr^{+++}	0.03%
SO_4	0.05%
Loss at 105° C	0.16%
Total	99.94%

Individual portions of the electrolyte were withdrawn from a 10-liter stock solution. Each portion of 267 ml. was used once only and then discarded. This precaution was a sensible one but not a critical one since a portion of electrolyte utilized three times yielded the same range results, within the limits of reproducibility of the cell.

Cleaning. Several methods of cleaning were utilized. Their individual use has been indicated in the tabular data. Generally, a scour with a thin slurry of Vienna lime was most commonly practiced. However, some cleaning was conducted in an electrolytic cleaner analyzing, when new, as follows: NaOH, 50%; $Na_4P_2O_7 \cdot 10H_2O$, 7%; $Na_2SiO_3 \cdot 5\ H_2O$, 24%; Na_2CO_3, 19%.

This cleaner was operated at 95° to 100° C. Copper and nickel were cleaned in it cathodically. Both current and voltage regulation were practiced.

Plating Procedure. The very nature of the Hull cell requires for maximum reproducibility that the conditions of operation be controlled very carefully. In brief, the degree of regulation attained was as follows:

Time, 5 minutes ± 10 seconds.

Temperature, ±0.5° C of noted cell

* 0.05 to 0.15 C; 0.3 to 0.6 Mn; 0.045 Max. P; 0.045 Max. S; balance Fe.

temperature. (Cell temperature was measured in the middle of the cell during operation. The only agitation was that caused by the anodic and cathodic gas evolutions, both of which were violent in nature. The wall gradient through the Hull cell was normally 5° to 6° C.)

Current. 10 amp. ± 0.1 amp.

It should be noted that the technic used, *i. e.*, immersion of the cell in a water bath at 39° to 40° C, would tend to begin plating with the cathode slightly cooler than the average temperature of the electrolyte. This factor was inconsequential since other considerations required that current be applied to the cathode within 10 seconds after it was introduced into the plating bath. The cell setup was such as to suggest that the cathode might be slightly colder than the plating bath. On the other hand, at a current flow of 10 amp. an appreciable warming of the cathode might occur at the high current density end. The unusually high values for the higher limit of the bright plating range could be explained by the latter effect.

Immersion, 2 in. ± 0.05 in.

Nomenclature

The electrodeposits resulting from the various experimental procedures have been described in the tabular data as follows:

Plating Range. The borders, where a distinct change occurred in the nature of the deposit, were marked on the experimental cathode at a height of 1 in. (25.4 mm.) from the bottom of the test plate. A straight edge was utilized to align these points of change with a corresponding point on the solid curve (Fig. 4). Both the point on the curve and the point on the test plate were always the same distance from the high current density end of the cathode and the curve. The value for the point of change was read from the curve and recorded.

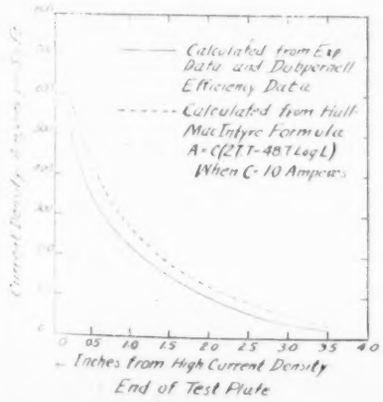


Fig. 4.

It was observed that most alterations in the appearance of the cathode could be described as follows:

No Deposit. The portion of unaffected cathode at the low current density end of the test panel.

Non-Metallic Deposit. Some panels had a band (always at the low current density end of the test panel) of what appeared to be chromium oxides.

Milky Plate. A semi-bright form of chromium deposit occurring on the low current density end of the test plate. This deposit was typified by the absence of any nodular structure.

Bright Plate. A deposit characterized by a high degree of essentially specular reflection. This class of deposit tolerated only the slightest degree of grayness. The limits of the bright plate range were determined by the presence of barely detectable grayness.

Gray Plate. A semi-bright to matte deposit of chromium occurring at the high current density end of the test panel and typified by some degree of nodular structure.

The Influence of Cleaning on the Plating of Buffed Nickel and Steel with Chromium

Table II presents the data concerning the effects of cleaning methods upon the ability of the cathode surfaces to accept chromium deposits. The data presented clearly demonstrate the complete inadequacy of cleaning alone in preparing buffed cathode surfaces of nickel and, to a much less degree, inadequacy in preparing similar steel cathodes. As would be predicted, anodic cleaning of nickel increased the difficulty of covering the cathode. In Table I, the first line of data reveals how plate distribution has been influenced by anodic cleaning. Cathodic cleaning of nickel improves coverage slightly as is indicated both in the second line of Table I and in Table II. Although the plating range was nearly identical, the plate was gray over a good portion of the area covered. Anodic cleaning of steel appeared to decrease the ease of coverage, an argument for the customarily used acid treatment after anodic cleaning of steel prior to chromium plating.

TABLE II

The Influence of Cleaning on Chromium Plating of Buffed Nickel and Steel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
No pickling after cleaning.

Experimental Variables	*Metal*	*Hull Cell Ranges in Amperes per Square Foot*				
		No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
Vienna lime slurry scour	Nickel	0-120	120-155		155-475	
Alkaline cleaner 45 g./L, 93° C, cathodic at 6 volts, 60 sec.	Nickel	0-50	50-86		86-100	100-475
Alkaline cleaner 45 g./L, 93° C, cathodic at 6 volts, 10 sec.; anodic at 6 volts, 5 sec.	Nickel	0-170	170-225	225-475		
Alkaline cleaner 45 g./L, 93° C, anodic at 6 volts, 5 sec.	Nickel	0-170	170-225			225-475
Vienna lime slurry scour	Steel	0-36	36-50		50-312	312-475
Alkaline cleaner 45 g./L, 93° C, cathodic at 6 volts, 60 sec.	Steel	0-20	20-62			62-475
Alkaline cleaner 45 g./L, 93° C, anodic at 6 volts, 60 sec.	Steel	0-30	30-75		75-380	380-475

(To be concluded next month)

References

1. Pierce, U. S. Pat. 1,645,927 (1928).
2. H. E. Haring and W. P. Barrows, "Electrodeposition of Chromium from Chromic Acid Baths," p. 436-7, Technologic Papers of the Bureau of Standards for 1927.
3. Hiram S. Lukens, "Influence of the Cathode on the Electrodeposition of Chromium," Trans. Electrochem. Soc. 53, 491-8 (1928).
4. J. W. Cuthbertson, "The Electrodeposition of Chromium and the Influence of the Cathode Metal," Trans. Electrochem. Soc. 59, 401-28 (1931).
5. Richard Schneidewind, "A Study of

(*Continued on page 345*)

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING—BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Separating Fluid

Question: In the making of phonograph records I understand they treat the master matrix with a "separating fluid" thereby producing a conductive film which permits a perfect deposit and at the same time makes it possible to subsequently separate the deposit, intact, from the basic metal.

What chemicals will I use in making a "separating fluid" to separate copper from copper?

E. M.

Answer: We suggest the following solution:

Potassium dichromate	0.3 g./l.
Borax	0.5 "

Surface Preparation

Question: We are interested in plating on 18-8 stainless steel and would like to know the necessary surface preparation and base coat needed for a final finish of either silver or gold.

S. K.

Answer: After cleaning in the usual manner, the article should be dipped in a 50% by volume solution of hydrochloric acid and then treated as cathode in the following solution:

Hydrochloric acid	1 pt./gal.
Nickel chloride	2 lbs./gal.

6 volts, room temperature, 15 to 60 seconds. Nickel or carbon anodes.

After this treatment, the article may be rinsed and plated as desired.

Hardness Determination

Question: We are interested in doing some work on the relative hardnesses of chrome plate in connection with some parts subject to impact. Could you inform us what method of hardness determination is used on deposits from .001" to .005" backed up by hardened steel of approximately Rc 60, and where such equipment can be obtained.

Also where can we obtain copies or photostats of the following articles mentioned under the Chromium section of your "Technical Developments of 1945," in the January issue of *Metal Finishing?*

1. (145) Machinable Chromium-Deposits—by Makepiece, J. Electrodep. Tech. Soc. 20, 69 (1945).
2. (150) Hard Chromium Plating, Monthly Review A. E. S. 32, 58 (1945).
3. (151) Unique Racks and Plating Fixtures, Vaughn & Usher, Metal Industry 67, 170 (1945).

D. L. C.

Answer: Diamond pyramid hardness testers are generally employed for determining the hardness of electrodeposits. Instruments of this type are obtainable from the following sources:

Wilson Mechanical Co., Inc.,
New York City.
H. A. Holz,
New York City.
Eberbach and Son Co.,
Ann Arbor, Michigan.

The Spencer Instrument Company of Rochester, N. Y., at one time made a few scratch hardness testers of the type developed by Bierbaum. However, we do not know if these are still being manufactured.

Photostats of the articles mentioned may be obtained from the New York Public Library.

Tank for Silver Plating

Question: On page 93 of your *Plating and Finishing Guidebook*, is a statement relating to silver plating where you mention that iron tanks may be used and one of our questions is whether by iron you also mean steel. It seems to us that it would be rather difficult to obtain an iron tank in these times. We have in mind having plating and striking tanks made of welded sheet steel. Do you think tanks made from this material would operate efficiently? Assuming that there are disadvantages involved in using tanks of such material, would you kindly advise us concerning them, including the reasons for such disadvantages? We would also appreciate having your recommendation as to lining materials for metal tanks.

C. J. H.

Answer: The material usually employed for this purpose is a low carbon hot rolled sheet commonly known as boiler plate. The term "iron" is commonly used today to denote low carbon steels.

An article on tanks and linings by G. B. Hogaboom, Jr., and Nathaniel Hall appeared on pp. 63-66 of the February 1946 issue of *Metal Finishing*.

Plating by Brush

Question: We are requesting information on brush anodizing and brush chromium plating over contoured clad aluminum alloys. The information desired includes availability of local source of materials, physical characteristics involved in carrying out the process, limitations, etc.

E. S.

Answer: We do not know of any process for anodizing with the use of a brush but a chromium solution for this purpose is marketed by:

Warner Electric Company,
Chicago, Illinois.

Brighteners

Question: We are using the Rochelle Salt Cyanide Copper bath, the formula we are using is the same as is given in the 1945 *Guidebook*.

Would you kindly advise as to what we may use as an addition agent to obtain a bright deposit and rapid deposition?

L. W. C.

Answer: Sodium thiosulfate is commonly employed for this purpose in amounts up to ¾ lb./100 gal. For high speed, agitation and filtration should be employed.

Bronze Finish

Question: I am doing some plating work for a lamp company. To produce a bronze like finish we brass plate and then dip. Can you recommend any copper-tin plating baths to deposit bronze directly.

A. R.

Answer: Copper-tin solutions are not recommended and we suggest that you use either copper-zinc bronze or a copper-cadmium bronze given below.

BRONZE—

Copper cyanide	4.0 ozs.
Zinc cyanide	0.3 "
Sodium cyanide	5.0 "
Rochelle salts	2.0 "
Water	1 gal.

Temp.: 75°-100° F.
Current density: 2-4 amps./sq. ft.
Voltage: 1-3.
Anodes: brass—92% copper, 8% zinc.
Free cyanide: ½ oz./gal.

COPPER—CADMIUM—BRONZE—

Copper cyanide	3 oz./gal.
Sodium cyanide	4½ "
Cadmium oxide	⅛-¼ "
Sodium carbonate	2 "
Free cyanide	1 "

Temp.: Room temp.
Voltage: 1-3.
Anodes: Copper.

Etching and Brightening

Question: I am having trouble and wonder if you can help me as you have previously.

We are etching on stamped copper in a solution as follows:

Chromic acid	20 lbs.
Sulfuric acid	32 oz.
Nitric acid	32 "
Muriatic acid	8 "

After making a new solution, the etching turns out perfect. I find this solution is only good for one day's work. We keep adding sulfuric acid (16 ozs.) to try to build it up but it still doesn't etch as it did the first day.

Can you suggest a better solution? Any information would be greatly appreciated.

H. R. W.

Answer: We would suggest that you try the following solution:

40° Be ferric chloride	1 volume
Hydrochloric acid	1 "

After etching in this solution, the work can be brightened in the following:

Sulfuric acid	12 av. oz./gal.
Sodium dichromate	4 "

Comparing Thicknesses

Question: We have been asked the question many times in the past several months, "What thickness of electro-galvanizing is equal to a hot-dip galvanizing?"

If it is possible, we would appreciate your telling us where we could find some comparison data as to the average thickness in inches and comparative life of coatings in salt spray test and accelerated atmosphere tests.

We have been told by an unauthorized source that an electrozinc plate of 0.002" is equal to a standard hot-dip application. Is this correct?

D. J. G.

Answer: Comparative data on the corrosion resistance and life of these two coatings will be found in the book, "Protective Coatings for Metals," by Burns and Schuh. Copies are available from this office at $6.50, payable in advance.

Standard hot-dip coatings vary widely but a commercial coating of 2 oz./sq. ft. would be approximately 0.0017" thick.

Refinishing Watch Dials

Question: Our business consists mainly of refinishing watch dials in many various colors. A problem which confronts us at the present time is the reproduction of a very dense jet black. Enclosed you will find two samples of a black deposit which we would like to reproduce. Half of each dial has been coated with clear lacquer to produce a gloss, the other half of the dials have been left uncoated.

We would appreciate any information or formula which you can give us on this subject.

R. O. W.

Answer: This finish appears to be black nickel over a white nickel base. For production of black nickel deposits, one of the formulas listed in the *Plating & Finishing Guidebook* will be suitable.

Chromium on Brass

Question: Can you tell me whether there are any methods commercially applicable for plating chromium directly onto brass? Any information as to the procedure used will be greatly appreciated.

Could you also advise what is the acceptable thickness of decorative chromium plate?

M.C.

Answer: This procedure is used to some extent, but only on very cheap work since there is a tendency for the brass to corrode through the cracks in the chromium deposit. A good nickel plate should be used under the chromium.

An acceptable chromium plate will be 0.00001-0.00002" thick.

References

(*Continued from page 343*)

Chromium Plating," p. 17, Engineering Research Bulletin No. 10 (Sept., 1928), University of Michigan.

6. William Blum and George B. Hogaboom, "Principles of Electroplating and Electroforming," 2nd ed., p. 301, McGraw-Hill Book Company, Inc., New York, N. Y. (1930).
7. "Chromium Plating—Its Mechanical Applications," p. 7, Machinery's Yellow Back Series 5, The Machinery Publishing Co., Ltd., London (1936).
8. A. W. Hothersall, "The Adhesion of Electrodeposited Nickel to Nickel," First International Conference; J. Electrodepositors' Tech. Soc. (London) 13, paper No. 12 (1937).
9. George Dubpernell, "Chromium Plating," Modern Electroplating, special volume, pp. 123 and 131-8, The Electrochemical Society, New York (1942).
10. A. W. Logozzo, "Preparation of Surfaces for Hard Chromium Plating," Proc. Am. Electroplaters' Soc., pp. 33-37 (1942).
11. M. Kolodney, "Chromium Plating," p. 8, Information Release No. 4, War Metallurgy Committee, National Academy of Sciences, National Research Council, Washington, D. C. (1943).
12. William J. Harshaw and Kenneth E. Long, U. S. Pat. 2,299,054 (1943).
13. R. O. Hull, "Current Density Range Characteristics—Their Determination and Application," 1939 Proc. Am. Electroplaters' Soc., pp. 52-59; U. S. Pat. 2,149,344 (1942).
14. F. MacIntryre and R. O. Hull, "Plating Test Control of Plating Baths," Proc. Am. Electroplaters' Soc., pp. 95-104 (1943).
15. E. Muller, Z. physik. Chem. A 172, 348-352 (March, 1935).
16. E. Muller, Z. Elektrochem. 45, 242-248 (March, 1939).

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Silver Struggle Ends with Price Fixed at 90.5 Cents The many months of struggle to get a bill through Congress to fix the price of Treasury silver for industrial purposes ended on July 19, 1946 when both houses passed a measure which fixed the price at 90.5 cents an ounce. Since everyone knew the old Green Act was destined to expire on December 31, 1945, therefore sometime during 1945 identical bills were introduced in the House and in the Senate for the extension of the Green Act. The Senate bill never got to the floor because it was pigeonholed by the Senate Banking and Currency Committee. The House passed its bill to extend the Green Act last year and sent it to the Senate for action. There it was forgotten by the Senate Banking and Currency Committee. Since the Senate apparently decided not to act on the measure, the House used a little strategy to force the Senate into action by attaching to the Treasury and Post Office Appropriations Bill a silver rider which was identical with the measure it had passed as a separate bill. This brought the desired action for the Senate could not separate the rider from the appropriations portions of the bill. As a result the Senate held hearings from February 28, 1946 to April 19, 1946; and then on June 20, 1946 the Senate passed the bill after amending the silver rider to increase the price of silver from the House fixed price of 71.11 cents to 90.3 cents an ounce with an automatic increase to $1.29 an ounce in two years. This increase in price, and the other amendments, did not please the House. For this reason the conferees of both houses of Congress did not make much progress except that the Senate agreed to drop the clause which provided that two years hence the price shall increase from 90.3 cents to $1.29 an ounce. During these sessions the silver bloc noted that one silver supplier had offered silver at 70 cents an ounce on July 10, 1946 and then on the next day raised the price to 90 cents an ounce. This made the silver bloc fight all the harder for their price of 90.3 cents an ounce. For three weeks the Senate conferees held out for 90.3 cents and the House conferees refused to budge from their floor price of 71.11 cents an ounce. Since a meeting of mines appeared impossible, and since about 800,000 Treasury and Post Office workers were beginning to worry about their paychecks, another measure was passed on July 15, 1946 to fix the price of silver and to release the appropriations bill. Conferees were appointed for this measure. They came to an agreement, which was passed by both houses of Congress; and the Senate silver bloc won by placing the price at 90.5 cents an ounce.

The Causes for the Silver Struggle Some might ask what are the causes for this long period of disagreement? This disagreement was not merely a problem of supply and demand, of production and distribution for it had many political aspects. It was a fight between the silver bloc and the manufacturing consuming interests. It was a contest between the silver bloc of the Senate and those in sympathy with raising the price of unpledged Treasury silver and the manufacturing consumer conscious House. It was a combat between those who only see silver as money and those who differentiate between silver as money and silver as a commodity. It was a struggle between those who wish to lift the level of silver as medium of exchange and those who are opposed to such monetary theories. It was a battle between those who want the Government to issue silver dollars, or silver certificates, rather than issue short term notes and bonds and those who are not in agreement with such theories on money and credit. It was warfare between those who are hoarding silver to unload at a high price and those who are not in sympathy with such methods of speculation. It was a tussle between the silver producers and the manufacturing consumers because of the drop in silver production during the past few years and the increasing demand for silver in arts and industry during the same period. And it was a pairing of the silver bloc and a certain segment of the agricultural bloc,—who operate on the basis of if you will scratch my back, I will scratch yours.

Silver Production Costs Said to Be Higher At Congressional hearings, and by other means of communication, silver producers and others told members of Congress that producers of silver will lose money if the Treasury were authorized to buy and sell domestic silver at 71.11 cents an ounce because the cost of silver production they claim has risen from 60 to 70 per cent in recent years,—a condition which is said to have forced thousands of silver producing mines to close down.

Silver Production and Consumption Silver producers reminded Congress that the consumption of silver by the arts and industry had risen from 2,500,000 ounces in 1880 to 140,000,000 ounces in 1945. To put this another way they pointed to the conditions that new and increased uses of silver had caused the demand for silver to increase from 26,000,000 ounces in 1928 to 44,000,0000 ounces in 1940 to 140,000,000 ounces in 1945.

In Thousands of Ounces

	1928	1945	1946
Sterling silver	9,430	27,000	70,000
Plated ware	3,841	2,300	
Electroplating			
Photographic	6,561	26,800	15,000
Jewelry	2,212	15,000	12,000
Insignia, medals, novelties and optical goods		11,000	
Electrical	....	8,000	10,000
Bearings, engine	....	9,000	1,000
Dental and medical	502	2,000	1,500
Brazing alloys	....	38,000	10,500
Miscellaneous, industrial	3,245	....	5,000
Total	25,791	140,000	125,000

In contrast to this increasing demand for silver the producers reminded Congress that the domestic production of silver has dropped from 70,000,000 ounces in 1940 to 29,000,000 ounces in 1945; and that the world production of silver has declined from 275,000,000 ounces in 1940 to 175,000,000 ounces in 1945.

Retail Silver Prices Some members of Congress believed that the producers of silver were entitled to more than 71.11 cents an ounce not only because of the increased cost of production but also because they felt that the silverware retail prices have increased from 100 to 300 per cent during the past four years.

Treasury Silver Sold Under the Green Act Other members of Congress, in their efforts to raise the price of silver, reminded the manufacturing consumers that during the life of the Green Act the Treasury sold for industrial purposes 225,549,043 ounces of silver. They also refreshed the memories of manufacturing consumers that the Treasury sold 60,000,000 ounces of silver for industrial purposes during the first ten months of 1945; that 10,000,000 ounces were sold to suppliers and manufacturers during November 1945; and that it sold to suppliers and others 23,000,000 ounces in December 1945. One supplier was reported to have bought 19,616,000 ounces of Treasury silver during the fourth quarter of 1945.

Silver and Gold Prices Silver producers told members of Congress that if Treasury silver is to be sold for industrial purposes at 71.11 cents then the Treasury ought to sell its gold at $19.25 an ounce.

Silver Black Market Other silver producers complained to Congress that the black market was offering scrap silver at 85 to 90 cents an ounce. Some producers expressed the opinion that silver users could afford to pay $3.00 to $4.00 an ounce.

Want Silver for Currency One silverite told Congress that the Treasury should issue silver certificates against the present 225,000,000 ounces of free silver in the Treasury and thus retire $291,000,000 of the nation's debt and save the taxpayers about $5,800,000 in interest a year.

Silver Prices in India Others reminded Congress of the current price of silver in India. But in using these prices of India in support of their fight for a price of 90 cents for silver they overlooked that the great advances in the price of silver in India has been due (1) to general inflation in India, (2) to the demand for silver for women's ornaments, (3) to the ancient habit of hoarding in India, (4) to speculation, and (5) to the lack of the Indian's faith in paper money and his demand for silver coins.

U. S. Silver Prices Since 1897 To hold the price at 71.11 cents an ounce the manufacturing consumers told members of Congress that the price of silver in the open market during the past 40 years averaged about 50 cents an ounce. This assertion is substantially correct for the average annual high and low prices can be gleaned from the accompanying table.

In Cents Per Oz.
Average Annual Price

Period	*Low*	*High*
1897-1916	49.684	66.791
1917-1920	81.417	111.122
1921-1929	52.993	69.065
1930-1933	27.892	38.154
1934-1941*	34.775	64.273
1942-1945*	38.333	51.928

Notes: *Foreign Silver

Source: Engineering & Mining Journal

Treasury's Opinion on Silver Prices Those who were opposed to increasing the price of Treasury silver above 71.11 cents an ounce pointed to a letter addressed to Representative Clarence Cannon from Joseph J. O'Connell, Jr. Acting Secretary of the Treasury, under date of June 24, 1946. In this letter among other things Mr. O'Connell wrote that the Treasury is "strongly opposed to any legislation" which ultimately aims to increase the Treasury price for newly mined domestic silver at $1.29 an ounce. In this letter Mr. O'Connell also states that "a greatly enhanced market price for silver will discourage the use of silver for coinage of other countries." Before it reaches $1.29 an ounce he predicted that "it will be profitable to melt the coins of Australia, Brazil, Iran and Sweden for their bullion content."

Silver Is a By-Product Others reason that since "silver is chiefly a by-product of lead, or zinc, or of copper mines, and were the increased price of silver to open new lead and copper mines, the price of those metals so useful to mankind would fall possibly to the full profit equivalent of the advance in the price of silver." In other words, since silver is largely a by-product of such base metals as copper, lead, and zinc, the profits from silver are used to reduce the cost of mining those metals.

New Method of Purifying Rhodium Plating Baths Developed Dr. Abner Brenner, president of the Baltimore-Washington Branch of the A.E.S. and of the National Bureau of Standards' Electrochemistry Section, with Walter A. Olson of the same section of the Bureau, have developed a simple method of purifying rhodium plating baths. Potassium ferrocyanide is used to precipitate the metallic impurities which are then removed by filtration.

Nickel Substitute Developed by Germans Report PB-17553 of the Office of the Publications Board, Department of Commerce, describes a German developed metal substitute for nickel in radio tube electrodes which is said to be cheaper and possessed of more desirable qualities for some applications. The metal substitute consists of an oxygen-containing iron sheet, plated on both sides with silicon containing aluminum layers approximately .010 millimeters thick.

New Method of Determining Iron and Zinc in Protective Coating The Rock Island Arsenal Laboratory developed a polarographic method of determining the iron and zinc content in protective phosphate coatings. The method is described in a 26 page report, (PB-4397) which can be had from the Office of the Publication Board of the Department of Commerce. A photostatic copy costs $2.00; and a microfilm copy costs 50 cents.

Lead Coating Research Results Now Available The Department of Commerce's Office of Technical Services is prepared to furnish to anyone for $2.00 a photostatic copy of Report PB-18829 which presents the results of wartime research conducted by the Battelle Memorial Institute on lead coating of steel by electrodeposition and other methods. The report points out that cold reduction of lead coated steel causes the coating to have fewer and smaller pinholes. The tests revealed that light electro- and hot-dipped coatings (less than 0.00025 inch) afford only short lived protection to steel exposed to the atmosphere. Thin coatings also show more pinholes than thick coatings. Commercial hot-dipped or electro-zinc coatings on terne plate, the report states, give more protection against atmospheric corrosion than electro- or hot-dipped lead coatings (0.00025 inch or less in thickness). Inexpensive supplementary coatings of certain waxes are said to be very effective in retarding corrosion in salt spray, humidity and other corrosion tests.

No Price Discriminations Permitted on Rated Orders On July 3, 1946 the Civilian Production Administration announced that "no price discrimination may be made against rated orders." And it added "that suppliers in the event of price changes, must give buyers with preference ratings at least seven days in which to agree to new prices." To put this another way an amendment to Interpretation 2 to Priorities Regulation 1 states that "there can be no discrimination in price against a rated order,

or between rated orders of different customers of the same class." The amendment also provides that when a price increase occurs after a rated order is accepted, the seller must continue to treat it as a rated order if the buyer is willing to meet the increased price. A seller cannot remove a rated order from his shipping schedule until he has given the buyer adequate notice of his intention to do so and the buyer has had adequate time, at least seven days, to agree to the new price.

Unions Plan Wage Increases Where No Contract Exists Now that the Stabilization Act has expired, all wage controls have automatically ended. As a result the CIO and AFL unions are expected to ask for wage increases from 10 cents to 20 cents an hour where they, the unions, are not bound by contracts.

Employment Rising The Bureau of Census of the Department of Commerce reports that "an increase of over a million and a half in the number of civilian workers took place between May and June, with the entrance into the civilian labor force of students and other seasonal workers as well as veterans of World War II."

World Production of Tin Only 50% of Prewar The International Tin Research and Development Council announced at The Hague, Holland, on July 7, 1946 that the world tin production during the first three months of 1946 amounted to 20,000 metric tons. This total production was said to be about 50 per cent of the average three months world production of tin during the period 1934-1938.

Commerce Department Creates Office of Technical Services The Department of Commerce has established the Office of Technical Services which is available for public consultation by the public. The OTS consists of four major units: the Invention and Engineering Division; the Industrial Research and Development Division; the Library and Reports Division; and the Technical Industrial Intelligence Division. The newly created office is headed by John C. Green, who was Executive Secretary of the Publication Board and Chief Engineer of the National Inventors Council.

Excess Profits Tax Refunds to Be Speeded Up The Bureau of Internal Revenue is taking steps to speed-up the refunds of excess profits taxes claimed by industry under Section 722 of the Internal Revenue Code. Charles D. Hamel has been named chairman of the newly organized Excess Profits Tax Council by the Bureau. This Council was established to help speed-up the process of refunding on the 36,000 applications filed.

Corporate Profits and National Income According to the Department of Commerce's Statistical Abstract the profits of corporations in 1945 represented 5.9 per cent of the total national income, as compared with 6.2 per cent in 1944, with 6.5 per cent in 1943, and with 6.3 per cent in 1942.

Federal Trade Revises Rules of Practice To conform with the views of the text and principles laid down in the Administrative Procedure Act of June 11, 1946 the Federal Trade Commission has revised its Rules of Practice.

OPA Granted Increase on Buffing Wheels Before it Died Among the last acts of the Office of Price Administration before it folded up its tents on June 30, 1946 was to grant a 17.3 per cent increase to the producers of buffing and polishing wheels.

Finished Metal Products Shipments in March The Bureau of Census of the Commerce Department reports that during the month of March 1946 the shipments of 11 engraving, plating and polishing concerns totaled $1,104,000; 57 jewelry; silverware and plated ware firms totaled $17,869,000; 57 lighting fixture firms totaled $8,922,000; 16 identification plate, badge and emblems companies amounted to $1,257,000; 11 military insignia firms totaled $249,000; and 14 manufacturers of metal musical instruments amounted to $1,222,000.

Antimony Will Be Tight the Balance of 1946 The Civilian Production Board predicted on July 17, 1945 that shortage of antimony will continue through the present year due to a drop in imports, increased demand over prewar normal requirements, and the falling of production in China because of the war.

Inventories to Be Tightened The Civilian Production Administration is preparing orders to tighten and extend inventory controls (1) to prevent speculative hoarding, (2) to salvage some of the effectiveness of the priorities system, and (3) to syphon off excess demand for scarce items.

Tin Production in Netherlands Indies Will Not Be Normal Until 1948 The Netherlands Information Bureau has just revealed that the tin mines at Bangka and Billiton were so badly damaged during the war that they will be unable to operate at full capacity until the delivery of eight 14-cubic-foot dredges. Six of these are in the process of construction in Holland; and two are being built in the United States. The dredges are not expected to be delivered until early in 1948.

Slab Zinc Production Dropping The Bureau of Foreign and Domestic Commerce of the Commerce Department reports that during the month of May 1946 the production of zinc slabs amounted to 62,416 short tons as compared with 69,440 short tons in May 1945.

Gold-Copper Alloy Solder Described in Report Report PB-15151 which may be had from the Office of the Publication Board, Department of Commerce, Washington, 25, D. C. for $1.00. This report describes an alloy of 37½ per cent gold and 62½ per cent copper said to be a useful solder, with a melting range of 950-990 degrees Centigrade. The Department of Commerce reports that "diffusion seals were made between pure copper parts by using .030-inch gaskets of the solder alloy. The seals are mechanically stronger than similar ones made with pure gold."

Zinc Mines Want Subsidy Restored It is reported that most of the zinc mines of southwestern Wisconsin and northern Illinois have closed because the subsidies for metals ended on July 1, 1946. The Government subsidies amounted to an average of $8.25 per 100 pounds of zinc and an average subsidy of $5.50 per 100 pounds of lead.

Porcelain-Enameled Products Shipments Increasing The Department of Commerce reports that United States shipments of porcelain-enameled products during the first five months of 1946 totaled $15,303,513 as compared with $13,774,403 for the same period in 1945.

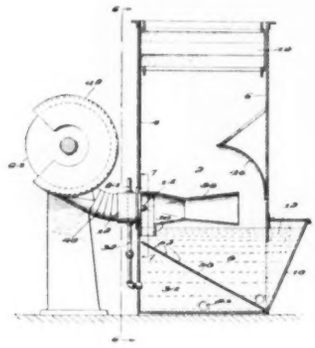
Premium Payments on Copper, Lead and Zinc May Be Continued Senator Abe Murdock of Utah has submitted amendments in the nature of a substitute intended to be proposed to Senate bill 1815 to permit the continuation of certain premium payments with respect to copper, lead and zinc. The amendments were referred to the Committee on Banking and Currency.

Lead Hardship Pool Created by CPA The Civilian Production Board amended Order M-38 to provide for the setting aside of 25 per cent of all primary lead production, effective August 1st, as a hardship pool. Because of the current shortage of lead the third quarter allocations have been trimmed to 217,000 tons as compared with 232,000 tons in the second quarter of 1946.

Patents

Dust Collector

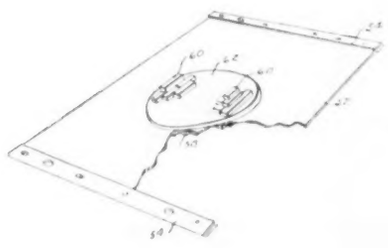
U. S. Pat. 2,399,629. E. F. Fisher, assignor to Whiting Corp., May 7, 1946. A dust collector for grinding operations, comprising an enclosure having a chamber in the bottom thereof, a horizontally disposed Venturi



tube opening into said enclosure above said chamber, a conduit connected to one end of the Venturi tube, an aspirating nozzle housed in a stream-lined housing and positioned in said conduit, said nozzle housing being provided with a passage for compressed air and with a water passage connected to said chamber, said nozzle being for simultaneously projecting air and water into the Venturi tube, for creating suction in the conduit and for projecting wetted dust against the opposite wall of said enclosure, and a dust collector connected to the suction end of said conduit.

Polishing Device

U. S. Pat. 2,399,924. R. Hayward, May 7, 1946. A polishing or grinding device for finishing surfaces, which comprises a stretched flexible substantially nonextensible diaphragm, a flexible abrasive-carrying tool attached to one diaphragm face, a rigid frame to which the periphery of the diaphragm is



attached and means for applying adjustably varying pressure to selected points on the other diaphragm face opposite the tool.

Vitreous Enameling

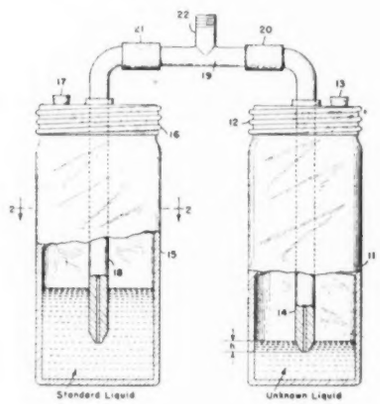
U. S. Pat. 2,398,881. M. Brown and R. E. Harr, assignors to Western Electric Co., Inc., Apr. 23, 1946. In an enamel coated article, a ferrous base, a copper coating on the base, a layer of nickel-manganese alloy comprising from .20% to 5.0% manganese and the balance nickel on the copper, and a coating of vitreous enamel on the alloy.

Vitreous Enameling

U. S. Pat. 2,399,094. M. Brown and R. E. Harr, assignors to Western Electric Co., Inc., Apr. 23, 1946. An enamel coated article comprising an iron base, a copper plated coating of around 20 milligrams per square inch thereover, a layer of nickel-cobalt alloy over the copper plate, said alloy comprising from 1.0% to 15.0% cobalt and the balance nickel and being substantially the same thickness as the copper plate, and a fused enamel coating over the nickel-cobalt alloy.

Measuring Surface Tension

U. S. Pat. 2,401,053. H. L. Cupples, assignor to The United States of America, May 28, 1946. An apparatus for determining the surface tension of an unknown liquid by the method of maximum bubble pressure, comprising a first vessel for containing the unknown liquid to be tested provided with a capillary tube, said tube extending downwardly in the vessel and supported in fixed position relative to the bottom and sides of



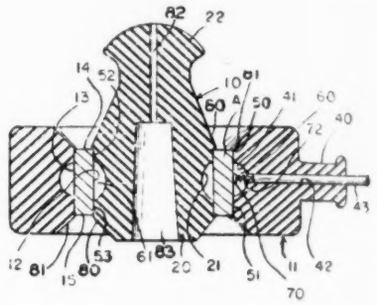
the vessel with the lower end of the tube a convenient distance from the bottom of the vessel, a second vessel for containing a standard liquid provided with a capillary tube, said tube extending downwardly in the second vessel and supported in fixed position relative to the bottom and sides of the vessel with the lower end of the tube a convenient distance from the bottom of the vessel, said second vessel being calibrated by determining the least pressures required to cause bubbles to emerge and break away from the submerged end of its tube with variations in quantity of the standard liquid, and means for placing the tubes in communication with each other and with a common source of gas pressure.

Stripping Anodized Aluminum

U. S. Pat. 2,399,134. M. A. Miller and W. E. White, assignors to Aluminum Co. of America, Apr. 23, 1946. A method for removing the oxide coating from aluminum surfaces, comprising subjecting said surfaces to the action of a solution containing about 1 to 5 per cent by weight water and from about 5 per cent to about 40 per cent by weight hydrogen fluoride, the balance of the solution being substantially made up of at least one compound selected from the group consisting of dioxan and those monohydric alcohols, polyhydric alcohols, and ethers containing at least one hydroxyl group derived from polyhydric alcohols, which have a melting point below about 40° C.

Plating Mask

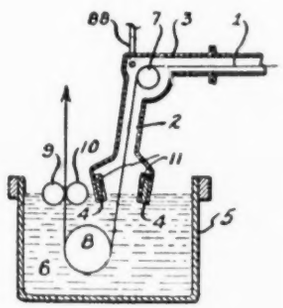
U. S. Pat. 2,401,415. J. E. Duggan, June 4, 1946. Means for protecting the outer surface of an annular member from paint or plating



material applied to other portions of said member, comprising a masking element having an annular body of resilient material and adapted to be sleeved upon said annular member to substantially cover the outer surface thereof, said annular body being provided in its inner face with an annular concave groove adapted to cooperate with the outer surface of the annular member to create a vacuum and having beveled portions upon opposite sides of and inclining toward said groove, said beveled portions being alternately engageable with opposite edges of the annular member to facilitate sleeving of the body upon the annular member, said body being slightly undersize relative to the outside of and adapted to be stretched upon said annular member so that the annular portions of the body between said beveled portions and groove will have pressure sealing engagement with the outer surface of said annular member.

Hot Dipping Strip

U. S. Pat. 2,401,374. T. Sendzimir

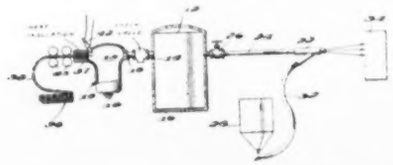


(France), assignor, by mesne assignments, to Armzen Co., June 4, 1946. In apparatus for the purpose described, a bath of molten metal, an elongated chamber through which heated strip metal to be coated is passed, means for maintaining in said chamber a non-oxidizing atmosphere, a connection between said chamber and said bath having a portion entering said bath, said last men-

tioned portion being enlarged as respects the body of said connection and provided with lips at the portion entering the bath of heat insulating character whereby to isolate and insulate a portion of said bath which may be maintained at a higher temperature than the remainder of said bath.

Abrasive Blasting

U. S. Pat. 2,399,680. W. L. Keefer, assignor to Pangborn Corp., May 7, 1946. A



method of propelling abrasive particles at blasting velocities which comprises, deflagrating a combustible material in a confined space to provide a gaseous medium under pressure, storing the gaseous medium under pressure permitting the gaseous medium to expand as a forceful jet, and entraining abrasive particles in the jet whereby the abrasive is moved forwardly as a blast stream.

Tin Bath

U. S. Pat. 2,399,194. J. W. Andrews, assignor to Carnegie-Illinois Steel Corp., Apr. 30, 1946. The process of electrodepositing tin which comprises electrolyzing an aqueous acidic tin plating solution of a tin arylsulphonate in the presence of a sulphoxide addition agent in an amount not less than about 1 gm. per liter, and which is designated by the general structural formula OH—R—SO—R′—OH where R and R′ represent a ring selected from the group consisting of benzene and naphthalene, the sulphoxide addition agent being in solution.

Vitreous Enamel

U. S. Pat. 2,399,232. I. Kreidl and W. Kreidl, Apr. 30, 1946. In the method of preparing vitreous enamel and glazes from an enamel mass free from a suspension agent the step of introducing a gas opacifier composition into the enamel mass, said gas opacifier composition being a gas opacifying substance incorporated in the pores of an inorganic gel-like substance capable of distributing and subdividing said gas opacifying substance in its pores.

Vitreous Enamel

U. S. Pat. 2,399,233. I. Kreidl and W. Kreidl, Apr. 30, 1946. In the process for the production of vitreous enamels the step of preparing an enamel slip at least from an enamel frit, clay, water, and a gas opacifying substance being incorporated in the pores of an inorganic gel-like substance which in the dry state and without the gas opacifying substance incorporated therein has pores which are substantially of submicroscopic size and which contains at least about 70% by volume air and which is capable of substantially shielding said gas opacifying substance from the clay and the frit.

Rhodium Plating

U. S. Pat. 2,401,331. A. Brenner and W. A. Olson, assignors to The United States of America, June 4, 1946. The method of treating a rhodium plating solution to maintain high reflectivity of rhodium coatings electrodeposited therefrom, which consists in removing from the plating solution, when the reflectivity of such coatings tends to diminish, zinc and like base metals the presence of which is deleterious to such reflectivity, such removal being effected by adding to the plating solution a solution of potassium ferrocyanide in slight excess of the amount necessary to precipitate such metals as ferrocyanides, removing the excess ferrocyanide by addition of ferric sulfate, separating the solution from the resulting precipitates, and then returning the separated solution for further electrodeposition of rhodium coatings therefrom.

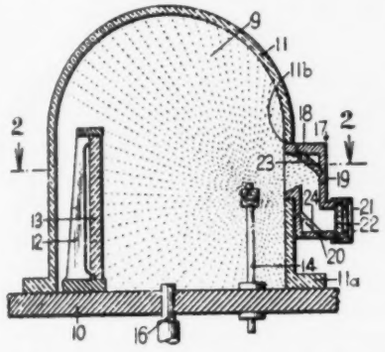
Electroplating Machine

U. S. Pat. 2,399,254. E. W. Rieger and C. J. Klein, assignors to National Steel Corp., Apr. 30, 1946. Apparatus for continuously electroplating a moving strip of material having a conductive face comprising a horizontally disposed electroplating cell having electrolyte therein and adapted to have the strip move in a horizontal plane across the cell from end to end with the face thereof in contact with electrolyte in the cell, an anode supporting structure in the cell below the plane of the strip presenting a surface inclined with respect to the horizontal extending across the cell laterally to the direction of movement of the strip and submerged in the electrolyte, the inclined surface being formed of electrically conducting material and adapted to be connected to

a source of electroplating current, a plurality of elongated anode elements in contiguous relationship to one another movably supported on the inclined surface, the anode elements extending in the direction of movement of the strip, each anode element having a bottom surface in electrical contact with the inclined surface and a top surface, the top surfaces lying in a common plane adjacent the underside of the strip and presenting an area having a width substantially corresponding to the width of said face.

Vacuum Metallizing

U. S. Pat. 2,401,433. A. R. Weinrich, assignor to Libbey-Owens-Ford Glass Co., June 4, 1946. An apparatus comprising a high vacuum chamber for the deposition of materials therein and a periscope-like member



attached thereto permitting the continuous observation throughout deposition operations being carried on within the vacuum chamber, said periscope-like member comprising a pair of angularly disposed spaced reflectors one of which faces towards the interior of the chamber, the reflective surface of the second reflector facing away from the interior and being arranged to receive images from the first reflector, and a transparent window adjacent said second reflector through which the images therein may be viewed, said transparent window being sealingly mounted in a wall of said chamber and the second reflector further being arranged to shield the transparent window with respect to the depositing material to thereby maintain said transparent window out of range of the material being deposited within the chamber.

Coating with Aluminum

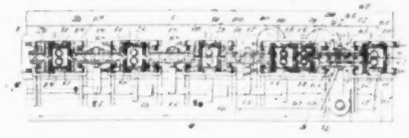
U. S. Pat. 2,400,304. W. W. Hamel, assignor of two-thirds to A. E. Lackenbach, and one-third to L. Stark and S. Kaplan, May 14, 1946. A process for coating paper articles with aluminum, which comprises wetting the surface of the articles with glycerine and then spraying fused aluminum upon the wetted surface.

Tarnish Prevention

U. S. Pat. 2,400,784. J. B. Rust, assignor to Montclair Research Corp., May 21, 1946. A process for protecting silverware from tarnishing which comprises applying to the surface thereof a dilute aqueous solution of a fatty acid salt of a primary aliphatic amine, the fatty acid containing from 1 to 4 carbon atoms and the primary amine from 12 to 22, removing the water therefrom, and buffing the surface.

Electrogalvanizing

U. S. Pat. 2,399,964. C. H. Ward, assignor to Bethlehem Steel Co., May 7, 1946. The method of coating and polishing a sheet of ferrous metal with zinc by electrodeposition in a continuously progressing operation, which comprises subjecting the sheet as an anode to the action of an electric current



in the presence of an electrolyte to clean the sheet, then subjecting the sheet as a cathode to the action of an electric current in a cell containing an electrolyte consisting essentially of zinc sulphate and sulphuric acid dissolved in water having an electric current connection on each side of the cell to plate the sheet, and finally polishing the zinc coating by subjecting the sheet without access to the air after the plating operation while still submerged as an anode to the action of an electric current in the presence of the same electrolyte used for zinc plating to slightly deplate the coating on the plated sheet.

Belt Polishing

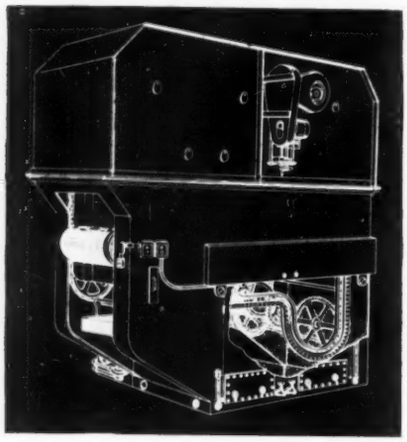
U. S. Pat. 2,402,131. B. F. Fowler, assignor to The Studebaker Corp., June 18, 1946. A backing wheel for a polishing or finishing belt having a relatively yielding fabric body comprising a plurality of sections each of which is composed of a plurality of fabric discs stitched together outwardly from the center to a distance short of or spaced inwardly from the circumference of the wheel an amount that will provide the desired degree of softness or yielding character along the circumference of the wheel, and said fabric body having its circumference covered with an outer non-abrasive coating secured to the circumference of said body and broken into an irregular patch work of individual pieces.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Vapor Degreaser

In addition to its present line of metal degreasing equipment, Detrex Corp., Dept. M.F., Detroit 32, Mich., has recently introduced a new standard conveyorized one-dip concentrator to the metal cleaning industry.



Called the "1 DC-750," this degreaser is small and compact. Designed to degrease small miscellaneous screw machine parts, it is ideally suited to small shops where floor space is at a premium. The machine occupies less than 75 square feet of floor space and measures but 9′ 9″ in height.

The unit may be supplied with rotary or a combination of rotary and flat baskets. Rotary baskets are 10″ diameter x 20″ long. Work to be cleaned is loaded at one end of the degreaser, carried through the cleaning cycle, and is returned through the upper hood to the same end of the machine for unloading. The conveyor system is complete with sprockets, shafts, take-up device, speed reducer and variable speed drive. All of the sprockets below the vapor line are zinc plated as are all crossrods and conveyor chains.

Pickling Inhibitor

Oakite Pickle Control No. 3, a new addition to the group of specialized Oakite cleaning, inhibiting, and neutralizing materials now in use in pickling-room procedures, has recently been made available.

A yellowish-brown, free-flowing powder with a density half that of water, the new material was designed primarily for inhibiting hot sulphuric-acid pickling solutions. It may also be used in mixed sulphuric-hydrochloric baths in which sulphuric acid predominates. Applications, reports the manufacturer, cover installations pickling many types of ferrous alloys and castings; hot and cold rolled steel; also where pickling is done prior to plating or phosphate coating or where zinc coatings are stripped.

On the basis of field tests conducted during the last year in steel, wire, and rolling mills, and electroplating, galvanizing and tinning shops, Oakite Pickle Control No. 3 is claimed to improve and economize the pickling cycle. Savings in metal, acid and maintenance costs have been reported, together with reduction in fuming, hydrogen embrittlement, pitting and discoloration of work. By retarding the build-up of iron sulphate in solution, the inhibitor is said to minimize the frequency and cost of spent liquor disposal.

Complete technical data, including performance graphs and instruction charts describing use and control of the new inhibitor by means of acid or ferrous-salt titration, are available without cost. Write on letterhead to Oakite Products, Inc., Dept. M.F., 24 Thames St., New York 6, N. Y.

Pressure Pump

A new positive pressure vane-type pump, VW-1, designed for handling non-lubricating liquids such as water has been announced by the Eastern Engineering Co., Dept. M.F., New Haven, Conn.

Incorporated in the pump are two composition bearings requiring no lubrication

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beyond that furnished by the liquid being pumped. The vanes are made of the same material as the bearing.

By means of a special design of the vanes and by applying the proper radii on the vane edges, the vanes are held in contact with the pump chamber. No centrifugal force, consequently, is required to maintain volumetric efficiency.

The pump is specifically designed for use in systems having a relief valve and therefore has no bypass valve built into the pump design. Shaft sealing is accomplished by means of a mechanical rotary seal.

Delivery approximates one-half gallon per minute. The pump is suitable for operating pressure of from zero to 30 pounds per square inch and is self-priming.

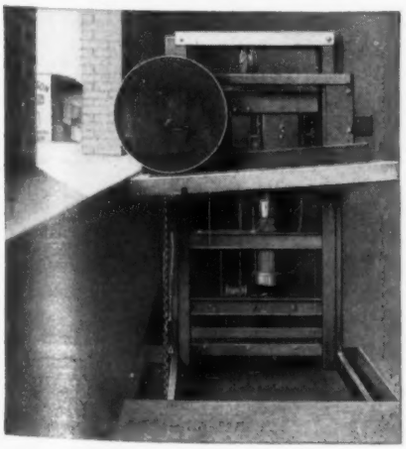
The Universal motor is 1/15 H.P. and is available in either 110 volts or 220 volts, A.C. or D.C.

Automatic Barrel Loader

Here illustrated is a special combination elevating and unloading machine built by Revolvator Company of North Bergen, N. J., manufacturers of portable elevators, hydraulic elevators, ramp eliminators, freight and passenger cable elevators, and Red Giant Liftrucks.

This automatic high speed barrel loader saves time and labor. It is an adaptation of a short lift standard portable non-revolvable elevator, incorporating the Zee Bar and other features found in the standard Revolvator line. Included in the design are safety features claimed to make accidents almost impossible. A standard motor hoist unit is used, consisting of herringbone and worm gears, motor and magnetic brake in one sealed unit with all shafts running in oil on ball and tapered roller bearings. Outboard end of shaft is carried on self-aligning precision ball bearings.

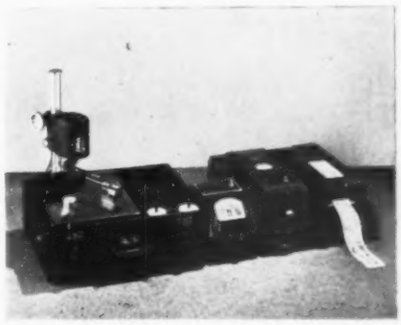
Operation of the automatic high speed barrel loader is practically self evident from the illustration. The machine is countersunk in position so that the top of the platform when lowered is flush with the floor. Barrels are rolled on to this platform by hand. Operator then throws the switch and the platform goes up. When the platform reaches the correct height for unloading it is tilted so that barrel automatically rolls off on to upper level. Platform then (immediately and automatically) returns to the lowered position for another loading. Barrel cannot roll off platform on the way up because a slight incline of platform keeps barrel against a raised stop which drops down at the proper height allowing barrel to roll off.



All the manual work, therefore, is done by one operator who rolls the barrel on and throws the switch. The machine can be made portable by equipping the frame with wheels if this is desired. Design permits making elevator to raise various size barrels, drums or hogsheads to any reasonable height. Full information may be obtained by writing to Revolvator Co., Dept. M.F., North Bergen, N. J.

Surface Analyzer

The new Model BL-103 Surface Analyzer, manufactured by The Brush Development Company, Dept. M.F., 3405 Perkins Ave., Cleveland, Ohio, checks surface finishes from less than 1 to 5000 microinches. Exploration is achieved with a fine diamond point. Instantaneous chart record on the Brush Magnetic Direct-inking Oscillograph provides accurate "peak and valley" profile of surface finish. Rapid warm up time (2 minutes) makes possible instant use in cases where time delay would affect inspection. Accessory equipment for the analyzer includes the Brush "RMS" Meter which provides a



constant visual check of "RMS" surface roughness where "peak and valley" profiles are not needed.

Measuring surface finishes of metals, glass,

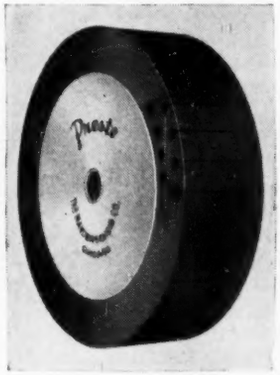
plastics, paper, plated and painted surfaces represent but a few successful uses of this instrument. Human error is eliminated by power-driven pickup and accurate chart record. Accurate calibration by absolute standard.

The new analyzer makes possible accurate surface analysis in the laboratory, early in the production line, or in final surface checking. This new aid to industry gives added accuracy to modern industrial inspection.

Contact Wheels for Abrasive Belt Polishing

No clogging of abrasive belts with increased production and longer belt life are improvements claimed for Presto Contact Wheels, as announced by The Manderscheid Co., Dept. MF, 810 Fulton St., Chicago 7, Ill.

Presto Contact Wheels are made of specially constructed Neoprene Rubber vulcanized to a metal core. The tough, resilient rubber affords uniform yielding quality for conformation to the work, assuring fast, uniform polishing. Complete freedom from hard spots avoid burning. The patented design snaps the belt as it leaves the work, beating it clean with 72 hammer strokes per revolution of the wheel. The abrasive belt is thereby kept clean and cuts effectively until the abrasive is worn off rather than clogged up. In actual production work these wheels are claimed to have more than doubled the rate of production and increased belt life three to one.



Presto Contact Wheels, 14" in diameter with 2", 3" and 4" face, are carried in stock. Diameters are precisely uniform and two or more wheels can be used together in forming any desired width.

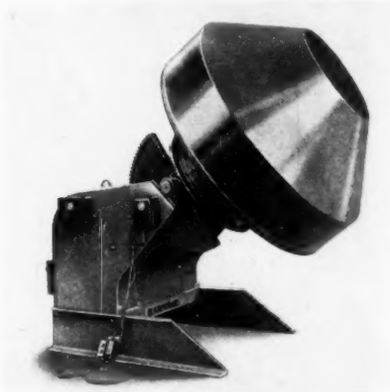
Three degrees of resiliency, Medium, Hard and Soft, meet just about any condition. Medium is suitable for 90% of polishing jobs. Hard is used for snagging and other coarse grained work. Soft handles plastics and extremely soft metals.

Literature mailed promptly on request to manufacturer.

Rotating Pan-Type Mixer

A new Rotating Pan-Type Mixer has been developed by Ransome Machinery Co., for a wide variety of uses in industries requiring mixing, blending, tumbling, polishing, finishing, and similar operations.

The rotating pan is motor-tilted and motor-rotated at constant speed. A variable speed drive can be furnished where materials handled require the rotating speed to vary. The pan is of all metal construction with joints welded and ground smooth. For mixing or blending two or more ingredients, mixing blades are added as necessary, to assure thoroughly mixed, uniform batches. With a 135 degree tilting range, materials are completely and cleanly discharged from the rotating pan. Safety limit switches are installed at the two extreme ends of the tilting range. The unit is operated by remote push-button control.



These Rotating Pan-Type Mixers are available in sizes up to 2500 lbs. (50 cu. ft.) batch capacity and are manufactured by the Ransome Machinery Co., Dept. M.F., 1497 South Second St., Dunellen, N. J., a subsidiary of Worthington Pump and Machinery Corp.

Wrench Sets

Adjustable Spanner Wrench Sets have been added to the JO Line tools manufactured by JO Manufacturing Co., Dept. M.F., South Gate, Cal. They come in three sizes which fit the following range of diameters: ⅝" to 2",

1¾" to 4", and 3½" to 6". Each wrench set is of forged steel, heat-treated and cadmium plated. A set consists of a handle, removable screw, a key arm, and three pin arms in graduated sizes. The spare pin arms shown fit the middle size wrench. With these tools it is unnecessary to carry several wrenches in a tool box as the spanner wrenches fit the range of diameters specified with any standard mechanic's handle.

Power Belt Conveyors

A new cable-lift device for easy elevation of the delivery head end of the Stevedore, Jr. series of portable power belt conveyors has been developed by the Rapids-Standard Co., Inc., Grand Rapids, Mich.

The cable-lift development presents new freedom, greater ease and increased safety in adjusting the operating pitch of the conveyor while stacking materials at various levels. Previously these constant pitch adjustments required considerable manual effort, but the addition of the new device eliminates necessity of the operator supporting any part of the weight of the equipment. Adjustment is simply accomplished by a few turns on the lifting crank handle.

All models of the Stevedore, Jr. now being manufactured will include the new cable-lift mechanism. However, this important new improvement has been so designed that present users of these conveyors may purchase the complete front cable-lift Rapid-Lock assembly for modernizing their present equipment.

The accompanying photograph illustrates design and construction features of the new cable-lift.

Clockwise turning of the crank winds the cable over the drum and pulls the entire T-arm assembly forward on the main conveyor frame channel, thereby elevating the delivery head end. Lowering is simply accomplished by releasing the safety rachet pawl with one hand and turning the handle with the other hand. The entire lift assembly slides back on the frame channel and lowers the delivery head end.

Inquiries regarding the new cable-lift development on the Stevedore, Jr. power belt conveyor should be directed to the Rapids-Standard Company, Inc., Dept. M.F., 302-40 Peoples National Bank Bldg., Grand Rapids 2, Mich.

Phosphate Coating

American Chemical Paint Co., Dept. MF, Ambler, Pa., has announced that Thermoil-Granodine is again available. This product is claimed to create a heavy iron manganese phosphate coating on steel which retards rust and when oiled prevents excessive wear on friction surfaces. These features especially appeal to manufacturers of pistons, piston rings, cam shafts, tappets, etc.

The oil-absorbing surface created by this phosphate coating quickly burnishes and holds the lubricant, thus largely eliminating the dangers in the "breaking-in" period of high-speed machinery.

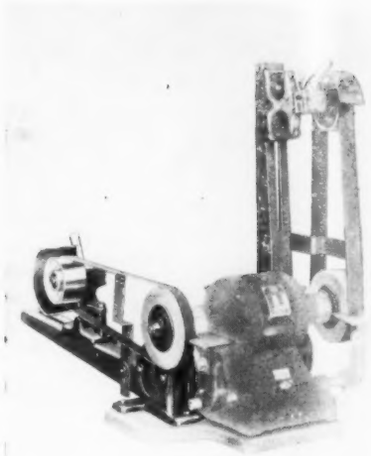
Thermoil-Granodine makes an excellent finish for many hardware items and when used under paint provides unusually good rust protection; but, if a high lustre is desired, the Spray-Granodine is recommended. The manufacturer claims that the latter produces a durable but smoother surface.

Technical Service Data Sheets will be sent on request to the company at the above address.

Light Belt Grinder Attachment

The Porter-Cable Machine Co., Dept. MF, Syracuse, N. Y. announces a new addition to its line of abrasive belt grinders.

A light, narrow belt grinder attachment, type N-2, has been developed capable of performing all kinds of light burring and grinding operations. Combining the versatility of platen grinding with the economy and speed of contact grinding it is ideal for light



grinding of flats, arcs, angles, gear burring, weld grinding, cleaning up operations, etc. A wide variety of composition and plastic materials, as well as steel, iron, aluminum, wood and glass are easily ground and surfaced.

This light and versatile attachment proves itself especially useful in tool rooms, sheet metal shops, pattern shops, garages, electrical shops, assembly, repair and maintenance departments or in any type of industry where light grinding and finishing operations are required.

The attachment is furnished without motor and is quickly aligned and attached to the familiar bench type wheel grinder, to which a resilient contact roll has been fitted.

The complete unit assembly stands 27″ high with a width of 2½″. A 6″ x 7″ T-shape base is drilled with 3 holes for convenient mounting to bench or work table. Platen size for flat grinding is 2″ x 4″. Resilient contact rolls 2″ x 6″ or 1″ x 6″ can be furnished. Using an endless abrasive belt 2″ x 48″ the attachment can be used either in the vertical, horizontal or any position (angle) between the 90 degrees. The abrasive belt grinding method assures faster cutting as well as cool and vibrationless operation.

Industrial Intercom Units

New dust and moisture-proof, metal-housed, industrial type intercom Staff stations for remote and privacy operation, have recently been introduced by Executone, Inc., manufacturers of electronic intercommunication and sound systems.

Equipped with a call-origination button, the remote type Model C-22 unit permits the user to receive a call and reply from a distance of twenty feet without approaching the station. The privacy type Model C-26 has a toggle switch for call origination, assuring freedom from eavesdropping when in idle position.

Designed for rigid mounting on wall or partition, these units are 6″ wide, 6″ high and 3″ deep. They can be wired directly to any standard Executone Central Control Master station, manufactured by Executone, Inc., Dept. MF, 415 Lexington Ave., New York City.

Business Items

E. F. HOUGHTON & CO. ANNOUNCE PERSONNEL CHANGES

Announcement of two new appointments is made by *Dr. R. H. Patch*, vice president in charge of operations, *E. F. Houghton & Co.*, manufacturers of industrial oils, chemicals and leathers, 303 W. Lehigh Ave., Philadelphia.

Dr. James T. Eaton, formerly research assistant to the vice president, has been made manager of research, in charge of the company's laboratories and product development. Dr. Eaton, a graduate of Central College, Missouri, and who completed his graduate work at the University of Illinois in 1934, has been with E. F. Houghton & Co. since 1937.

Henry H. High, formerly superintendent of laboratories, has been named superintendent of the Philadelphia Oil Department, in place of *D. M. Harvey*, resigned. Mr. High has been associated with the company since 1930, following graduation from Franklin & Marshall College and special metallurgical courses at Temple University. He will be in charge of manufacture of the company's many oil and grease products.

RADIO RECEPTOR CO., INC. ANNOUNCES NEW AGENTS

Seven new agents will represent nationally the Selenium Rectifier Division of *Radio Receptor Co., Inc.*, 251 West 19th St., New York, N. Y., manufacturers of radio and electronic equipment since 1922. *Ludwig Arnson*, president of the company, has announced.

Agents selected for Seletron, Radio Receptor's selenium rectifier include: *Bauman and Bluzat*, Chicago, Ill., *Irvin I. Aaron and Associates*, Milwaukee, Wis. and Minneapolis, Minn.; *M. M. Massey and Associates*, Washington, D. C.; *A. Sidney Hardy & Associates*, Atlanta, Ga.; *Delta Electronic Equipment Co.*, New Orleans, La.; *Western Agencies Co.*, Los Angeles, Calif. and *Arthur T. Hatton & Co.*, Hartford, Conn. and Boston, Mass.

DETREX CORPORATION ANNOUNCES NEW LOCATION

To meet increased sales volume due to the widespread use of Detrex metal cleaning equipment and chemicals by the automotive, aviation, and other metal working industries, *Detrex Corporation* is now occupying its new, modern, main plant and offices at 14331 Woodrow Wilson, Detroit, Mich.

As part of their large expansion program, this plant will widen the scope of personalized service offered by the company to all industrial plants having cleaning departments. Increased production facilities will enable the company to speed delivery on all types and sizes of Detrex degreasing equipment and metal parts washers.

Administrative, sales, purchasing, advertising, public relations, manufacturing, accounting and legal functions will all be handled at this new location, the mail address being P.O. Box 501, Detroit 32, Mich.

The former main plant on Hillview Ave. is being converted to fabricate equipment and market chemicals used by the drycleaning industry.

New plant and offices of Detrex Corp.

J. P. SEEBURG CO. INSTALLING NEW PLATING DEPARTMENT

The *J. P. Seeburg Company* of Chicago is nearing completion of an addition to their property which will house the new plating department. A $500,000.00 investment is represented. *Mr. Owen T. Towner*, the supervisor of finishes, supplied some of the following interesting statistics concerning the expansion program.

A 500 horsepower input will be required to operate this department which will employ approximately 35,000 amperes of low voltage direct current for plating. It will be set up with three full automatic plating machines of the latest type. 18,000 pieces of zinc die castings per day will be processed in chromium, 4½ tons of barrel work, and 21 tons of racked steel will be plated with copper, zinc, or cadmium.

A system of sewers capable of handling the rinsing water traverses the entire plating room, ending in a sump system so that the plating room wastes may be treated before passage to the public sewer system.

Two 175 horsepower boilers have been installed to provide heat and process steam for the department, operating at 25 to 30 pounds pressure.

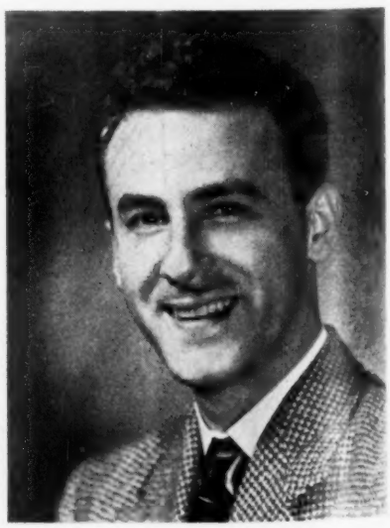
Zinc, bright copper, bright nickel, chromium, silver and tin plating will be done, in addition to which a large Bonderizing setup is included.

Complete conveyor systems have been installed to eliminate trucking and to facilitate all types of stock handling. These conveyor systems also include the installation of power washing machines for cleaning the parts prior to electrocleaning in the plating operations. It is expected that the entire installation will be completed by September 1st.

NEW APPOINTMENTS ANNOUNCED BY TURCO PRODUCTS, INC.

Appointment of *Thomas G. Franzreb* to the Technical Service Division Staff of *Turco Products, Inc.*, is announced by *Ray Sanders*, vice president and general manager of the company.

Mr. Franzreb is a graduate of Wagner College, New York City, and has done considerable post-graduate work in the field of chemistry at Columbia University. Entering the Navy in 1944, he spent two years as



Thomas G. Franzreb

Donald Keating

Materiels Laboratory Officer in the Engineering Division at Jacksonville, Florida. He was released from active duty in April 1946 with the rank of Lieutenant in the Naval Reserves.

He is located at company's Los Angeles office, 6135 South Central Ave., Los Angeles 1, Cal., and will be available at all times to assist in solving maintenance problems.

The company also announces the recent affilitiation of *Donald Keating* with their technical service staff.

A graduate of U.C.L.A. and Cal. Tech., Mr. Keating served in the Navy as executive officer on an L.S.T. during World War II. He saw action in the Pacific Theater at Leyte and Okinawa, later making three trips to Japan soon after V-J Day. He joins the company as technical service representative and will specialize in the solution of problems relative to cleaning and maintenance in the general industrial field.

NEW COMPANY IN ALUMINUM FINISHING FIELD

Ano-Color Engineers, announces its recent entry into the field of aluminum finishing. This new organization's modern facilities are located at 8405 Lyndon Ave. in central northwest Detroit.

The company is specializing in the anodizing and coloring of aluminum and its alloys. It is owned and operated by three graduate chemical engineers. Messrs. *F. F. Strale* and *C. J. Motycka* were formerly with *Aluminum Company of America* while *J. C. Friedel, Jr.* was associated with *Bohn Aluminum and Brass Corp.*

MITCHELL-BRADFORD REINCORPORATED

Mitchell-Bradford Chemical Co., 2446 Main St., Stratford, Conn., manufacturers of "Black Magic" blackening processes, "Silco," a glass-base, sprayed and baked coating, and also heat treating materials, has reincorporated as *The Mitchell-Bradford Chemical Co.*, as of May 1, 1946.

The officers of the Corporation are *A. J. Mitchell*, president, *J. W. Mitchell*, vice-president, and *M. F. Mitchell*, secretary and treasurer.

A. J. Mitchell has been active in the management and chemical research of the com-

pany, and is a founder of the original company. He is the principal stockholder in the new Corporation and will continue the active management of it.

Main offices and plant are located at Stratford, Conn. They also maintain a Mid-Western Office at Chicago, Ill., under the supervision of our *Mr. William H. Price, Jr.*, Mid-Western Regional Manager. The Company has warehouse stocks in Cleveland, Chicago, and San Francisco, with representatives spotted in strategic areas throughout the United States and Canada, with also representatives in foreign countries.

HARSHAW CHEMICAL COMPANY APPOINTS DR. FERNELIUS

Mr. W. J. Harshaw, president of the *Harshaw Chemical Co.* has announced the appointment of *Dr. Grant R. Fernelius* as plant manager of their Elyria, Ohio, plant.

Dr. Fernelius was born in Peterson, Utah, and graduated from the Ogden High School in 1931. After two years at Weber Junior College in 1933 he entered the University of Utah where he received the B. S. in Chemistry degree in 1935. In 1941 he received his Doctor of Philosophy in Chemistry from Western Reserve University, Cleveland, Ohio.

He immediately entered the Development Department of the Harshaw Chemical Co., finally becoming asst. chief development engineer and then asst. to the vice president in charge of manufacturing. Dr. Fernelius is a member of Alpha Chi Sigma and Sigma Xi.

Mr. Harshaw also announced that *Mr. Paul Hines*, formerly manager of the Elyria plant, has simultaneously become manager of the El Segundo (California) plant of the Company.

AMERICAN FOUNDRY EQUIPMENT CO. ANNOUNCES PERSONNEL CHANGES

Several important changes in administrative personnel have recently been announced by *American Foundry Equipment Co.*, 555 So. Byrkit St., Mishawaka, Ind.

Kenneth H. Barnes has been appointed chief engineer. Mr. Barnes has been with the company for 10 years, the first five of which were spent in the engineering department preparing proposal drawings and designing new equipment. For the last five years he has been in sales department where he held the position of assistant sales manager.

Chalmer R. Cline has been appointed engineering assistant to the president. Mr. Cline, who was recently separated from the U. S. Army Ordnance Industrial Service with rank of major, has had an extensive and varied business background. He taught engineering subjects at the University of Cincinnati, Lorain Institute of Arts & Sciences and the John Huntington Institute. His business connections have been principally in the engineering and research departments of *Commercial Steel Castings Corp., National Steel & Tube, Thew Shovel Co., American Gas Assn.* and *American Manufacturing Co.*

Sherrill S. Deputy, new assistant sales manager, comes to American Foundry Equipment Co. after an 18 year association with *International Business Machines, Inc.* His varied positions with I.B.M. were all of a

sales or administrative nature. Mr. Deputy is past vice-president of the *Omaha Chapter* of the *American Federation of Sales Executives*.

WILLIAM R. BURNS DIES

E. Reed Burns Manufacturing Corp., of Brooklyn, N. Y., announce with regret the passing of their representative, *Mr. William R. Burns* of Beloit, Wisc., on June 17, 1946.

Mr. Burns had represented the company in the Wisconsin, and Chicago territory since 1935.

Associations and Societies

JOB PLATERS
MEETING HELD AT PITTSBURGH

ONE of the outstanding events of the convention of the *American Electroplaters' Society* was a meeting of job platers held on Tuesday evening, June 18th, at the Hotel William Penn. This dinner meeting was attended by eighty-eight platers from all parts of the United States, from California to New York. The chairman was *Edward J. Musick*, of *Musick Plating, Inc.*, St. Louis, who presided in the absence of *R. J. O'Connor*, of the *Contract Plating Co.*, Bridgeport, Conn., who was unable to attend because of illness.

The official business was divided into two sections: first a report by *Adolph Bregman*, of New York, reviewing the progress of the job plating industry during the past year, and second, a report by *Raymond M. Shock*, of Detroit, on a plan for a proposed national association.

Mr. Bregman stated that during the past year, the industry as a whole had prospered, but was faced with a number of postwar problems such as a shortage of skilled polishers, miscellaneous plating materials, especially buffs and silver. He also mentioned cadmium and chromium chemicals as other materials that are hard to obtain.

Mr. Shock outlined the formation of a *National Association of Metal Finishers* to include platers, enamelers and rust-proofers. After extended discussion, it was voted to proceed with such an organization and to set dues on a graduated scale based upon the capacity of the member firms. The National Association will be composed solely of local groups in various parts of the country and firms will join their nearest local association.

During the next morning, another meeting was held by the Steering Committee at which ways and means were laid out for the organization. At the present time local associations are functioning in New York, Detroit, Boston, Chicago, Los Angeles, and San Francisco, but the national association will aid in the formation of new local groups as fast as possible.

One of the local groups to be formed will cover the Mississippi Valley, including in its territory, Missouri, Kansas, Oklahoma, Texas, Louisiana, Arkansas, Western Kentucky, Tennessee, and Southern Illinois. The prime mover in this organization will be Edward Musick, of St. Louis. Organizing

this group will be a tremendous job, but as Mr. Musick is a past president of the American Electroplaters' Society, a past chairman of the job platers meetings at the national conventions, and one of the best known job platers in the United States, his influence will undoubtedly be effective in organizing this broad group.

All platers in the territory described above are asked to communicate with Mr. Edward J. Musick, Musick Plating, Inc., 206 South 9th St., St. Louis, Mo.

The objects of the national association are to promote the general welfare of its members, especially as it may pertain to matters affecting management, labor relations, legislation, taxes, etc.

AMERICAN ELECTROPLATERS' SOCIETY

DR. WINSTON M. MANNING ADDRESSES CHICAGO BRANCH

"The regular monthly meeting of the *Chicago Branch* of the *American Electroplaters' Society* was held on Friday, June 14th. Another change in the meeting place brought it back to the *Atlantic Hotel* where it had been for many years prior to the war.

Dr. Winston M. Manning of the *University of Chicago*, addressed the group on the "*Heavy Elements*," chiefly the fissionable materials that have recently been prominent in scientific news with respect to the atomic bomb. He covered quite thoroughly the scientific aspects of uranium, neptunium and plutonium, indicating a new series of elements, analogous to the lanthanide series, but known as the actinide series, could be postulated from these new elements due to the similarity of their chemical properties. Methods for the production of some of these elements were touched upon, also the possibiliy of using such reactive materials for industrial power, were discussed. One of the most interesting features of the talk was the description of an extremely sensitive balance and other pieces of micro-chemical apparatus designed to handle microscopic amounts of these materials.

Due to the fact that the topic was of far more general interest than the usual technical discussions of electroplating and metal finishing, ladies were specifically invited to the meeting. More than 80 members and their wives attended, and from the discussion following the talk, an active interest in this topic was surely felt by those present.

ELECTROCHEMICAL SOCIETY

DR. H. JERMAIN CREIGHTON HONORED

The *Electrochemical Society* has awarded the *Edward Goodrich Acheson Gold Medal* and *Thousand Dollar Prize* to *Professor H. Jermain Creighton* of Swarthmore College for his outstanding accomplishments in electrochemistry. This is the very highest award in electrochemistry.

Dr. Creighton was born in Dartmouth, Nova Scotia, on March 2, 1886. He attended Dalhousie University at Halifax, Nova Scotia, receiving his Bachelor of Arts degree in 1906 and his Master of Arts degree in 1907. He then was awarded a fellowship and spent the next two years at Birmingham, England, obtaining his Master of Science degree there in 1909. He next spent a year at Heidelberg University and another year at the Polytechnikum at Zurich, Switzerland, where he received his Doctor of Science degree. Returning to Dalhousie University, he lectured on physical chemistry until 1912 when he was invited to Swarthmore College, Pennsylvania. He has headed the Chemistry Department of Swarthmore since 1928. The Franklin Institute awarded him the Longstreth Medal in 1918; and the Howard N. Potts gold medal in 1939 in consideration of his distinguished work in developing a process for the electrolytic reduction of simple sugars on a commercial scale. In Dr. Creighton's process, glucose is converted into sorbitol. Sorbitol has two principal values; first, as a moistening and softening agent; second, as an intermediate in chemical synthesis. The most important derivative at present is ascorbic acid (vitamin C).

In 1940 the *National Association of Manufacturers* presented Dr. Creighton with the "*Pioneer Award*" on account of his work on sugars.

Dr. Creighton has been a very active member of the Electrochemical Society and has served as its President in 1939-1940.

Dr. Creighton is the author of one of the very best books on the *Principles of Electrochemistry*. It was originally published in

1924 and has gone through four editions.

The Acheson Medal and Prize were founded by *Dr. Acheson*, inventor of carborundum and artificial graphite. Previous recipients of the medal are *Edwin F. Northrup, Colin G. Fink, Frank J. Tone, Frederick M. Becket, Francis C. Frary, Charles F. Burgess* and *William Blum*.

The presentation of the medal to Dr. Creighton is scheduled for Thursday evening, October 17th, 1946 at Toronto, Ontario, in conjunction with the 90th Congress of the Electrochemical Society.

AMERICAN STANDARDS ASSOCIATION

ASSOCIATION ISSUES NEW BOOKLET

A revised list of standards approved to date has been published by the *American Standards Association*.

The 845 standards listed in the booklet include definitions of technical terms, specifications for metals and other materials, dimensions, safety provisions for the use of machinery, methods of work and methods of test for the finished product. They reach into every important engineering field, serving as the basis for many municipal, state, and federal regulations.

The standards are widely used throughout industry since they represent agreement on the part of maker, seller, and user groups as to the best possible practice at the time of approval. They are constantly revised to keep up with the mechanical invention, developments of power and new uses for materials.

The 154 American War Standards listed on pages 15 and 16 of the booklet, which gave vital help to the Army, the Navy, and the War Production Board, are now being reconsidered for their possible value as American Standards in connection with peacetime production.

The complete list of American Standards should serve as valuable reference material to engineers, manufacturers, sales organizations and consumer groups. It will be sent free of charge to anyone interested. Requests should be addressed to the American Standards Association, 70 East 45th St., New York 17, N. Y.

NATIONAL LIME ASSOCIATION

FELLOWSHIP ESTABLISHED AT RUTGERS UNIVERSITY

The *National Lime Association* has established a Fellowship at *Rutgers University* in the department of Sewage and Waste Treatment. This Fellowship is a continuation of work that has been carried on for some time by the Association and is highly important in the broad general program of the treatment of industrial wastes which is now receiving considerable attention. The Fellowship is under the direction of *Dr. Willem Rudolfs* who selected *Mr. R. P. Logan*, a former National Lime Association fellow, to be directly in charge of the project. *Mr. R. V. LeVine*, Ch.E. a graduate student, is carrying out the laboratory work.

The program is concerned with the utilization of various types of lime products in the treatment of water wastes. An important phase of the work is the study of the utilization of lime in the treatment of pickling liquor such as is obtained from steel producing and fabricating centers. Particular emphasis is being placed on the difficult sludge problem that is associated with this neutralization. This sludge problem is of prime concern especially to the small industries and it is hoped that considerable information will be developed regarding means of producing low sludge volume, high rates of dewatering of sludge, rapid settling, etc.

In addition to the work on pickling liquor a study is being made of the neutralization of the various types and mixtures of acids present in industrial waste products. Here again specific emphasis is being placed on methods of avoiding the formation of high sludge volumes.

A section of the work is devoted to a consideration of the various types of equipment that may be employed in the lime treatment. For example, consideration is being given to various types of lime feeders, mechanical slackers, sludge production and disposal apparatus, and to various types of mixing equipment.

Results of this work will be made available to the public through publications of the National Lime Association and in other technical journals.

AMERICAN SOCIETY FOR TESTING MATERIALS

DR. H. R. COPSON AWARDED CHARLES B. DUDLEY MEDAL

The nineteenth award of the *Charles B. Dudley Medal* of the *American Society for Testing Materials* was presented recently to *Dr. Harry R. Copson*, research chemist with the Bayonne Research Laboratory of *The International Nickel Co., Inc.*, during the annual meeting of the Society held at the Hotel Statler in Buffalo, N. Y. *John R. Townsend*, president of the Society, made the presentation. The award is given for the outstanding paper of the year involving original research and was in recognition of Dr. Copson's paper on "*A Theory of the*

Mechanism of Rusting of Low Alloy Steels in the Atmosphere."

A native of Easthampton, Mass., Dr. Copson now resides at Cranford, N. J. He graduated from Massachusetts State College with a B. S. degree in 1929, and from Yale University with a Ph. D. in physical chemistry in 1932. After serving as chief chemist with Apothecaries Hall Co. at Waterbury, Conn. for more than a year, Dr. Copson joined the Research Laboratory of International Nickel at Bayonne in June, 1934. As research chemist he has in recent years been connected with the Chemical and Corrosion Section of this Laboratory.

Dr. Copson has written numerous technical articles and papers dealing with corrosion of metals. He is a member of the *American Institute of Chemical Engineers, American Chemical Society* and *The Electrochemical Society.*

PORCELAIN ENAMEL INSTITUTE

FORUM TO FEATURE PRODUCTION

"*Production*" will be the theme for the *Eighth Annual Forum* of the *Porcelain Enamel Institute*, set for October 9, 10, and 11, at the University of Illinois. Improved methods of metal fabricating, enamel processing, and shop control will be featured.

Speakers will be outstanding men with practical shop experience who can talk authoritatively on their subjects and discuss applications to individual shop operations.

Primary purpose of the Porcelain Enamel Institute Forum is to help the men who run enameling plants. The Forum is designed to provide them with useful and usable information on new developments, materials, methods and equipment that contribute to manufacturing efficiency. Last year's Forum at Ohio State University was built around the idea of a refresher course to provide men returning to their old jobs with a thorough review of the fundamentals of porcelain enamel processing—in line with the industry's concern over quick reconversion to civilian production.

Program

The 1946 Forum program will include papers and discussion of the following:

Wednesday, October 9
- Registration
- Symposium on Cleaning and Pickling Equipment and Practice

Thursday, October 10
- Atomic Hydrogen Welding, Enamel Shop Housekeeping, Safety in the Enamel Plant
- Symposium on Tests and Test Methods—Practical Test Methods for Shop Use

Friday, October 11
- Enamel Shop Production Problems: Use of Portable Conveyors, Firing Ground Coats and Cover Coats Together, De-Enameling
- Decorative Processes for Porcelain Enamel, New Angles on Reclaimed Enamels, Problems in Porcelain Enameling Non-Enameling Sheets

Registration Details

Participation in the Forum is open to employees and representatives of all manufac-

turers and suppliers of the porcelain enamel industry, as well as to everyone interested in the advancement of porcelain enameling. Registration fees have been set at $10.00 for the complete three-day session; $7.50 for two days; and $5.00 for one day.

The Forum Committee has announced that all hotel reservations must be made through the Porcelain Enamel Institute (1010 Vermont Ave., N.W., Washington 5, D. C.), as hotels will not accept individual applications. The Committee also requests that those planning to attend notify the Institute now, so that general plans can be made. Final commitments and reservations will be checked and confirmed at a later date.

Forum Committee

Chairman of the Forum Committee is *F. E. Hodek, Jr.*, of the General Porcelain Enameling and Mfg. Co. Committee members include: *A. I. Andrews*, University of Illinois; *J. E. Hansen*, Ferro Enamel Corp.; *R. M. King*, Ohio State University; *L. E. Nordholt*, Tennessee Enamel Manufacturing Co.; *F. A. Petersen*, University of Illinois; *E. H. Shands*, Geo. D. Roper Corp.; *N. G. Wedemeyer*, Rohm and Haas Co.

AMERICAN SOCIETY FOR METALS

The *American Society for Metals* has announced five nominees for the Society's national officers and trustees for 1946-1947. Such nominations are tantamount to election.

Arthur L. Boegehold, head of the metallurgy department, *Research Laboratories Division, General Motors Corp.*, Detroit, incumbent vice president of the Society, was nominated for president. Mr. Boegehold is a graduate of Cornell University and has been with General Motors since 1925, prior to which he was with *Remington Arms Co.*, and the *Bridgeport Brass Co.*, both of Bridgeport, Conn. He is a past chairman of the Detroit Chapter of the Society and was selected to deliver the important *Campbell Memorial Lecture* before the ASM in 1938.

Francis B. Foley, vice presidential nominee, was graduated from Girard College and started his metallurgical career with the *Midvale Co.*, Nicetown, Philadelphia, Penna., in 1905. Later he taught metallography at the University of Minnesota, engaged in research projects for the U. S. Bureau of Mines. In 1926 he returned to the Midvale Company as superintendent of research. He is past chairman of the Philadelphia Chapter of the Society.

William H. Eisenman, national secretary of ASM since its organization in 1918, was nominated for re-election for his 15th consecutive 2 year term.

Dr. John E. Dorn, associate professor of physical metallurgy of the University of California, and *Dr. Arthur E. Focke*, research metallurgist of the *Diamond Chain and Mfg. Co.*, Indianapolis, were nominated for two year terms as trustees of the Society. Dr. Focke is past chairman of the Indianapolis Chapter of ASM.

Formal elections and induction into office will take place at the ASM annual meeting in Atlantic City during the week of November 18th as part of the *National Metal Congress and Exposition.*

THE PLATING INSTITUTE

A NEW SERVICE OFFERED TO MANUFACTURERS

In order to assist manufacturers in selecting the type of plating, rustproofing or metal finishing best suited to their purpose, *The Plating Institute*, Dime Building, Detroit, Mich., has established a committee of experts to consult with and advise those interested.

Raymond M. Shock, executive secretary, states, "Many new metal finishing, plating and rustproofing processes were developed during the war for which local facilities are available, and it is the purpose of the Institute to help manufacturers facilitate their requirements by supplying information relative to processes and reliable sources to do the work."

There will be no charge for this service and it is hoped it will be used freely by all those whose products require plating or rustproofing.

Shock says, he believes the service should be invaluable to smaller companies and those not having finishing and processing engineers of their own. A letter or call to the Institute, 2237 Dime Building, RAndolph 9194, will receive prompt attention.

Manufacturers' Literature

Publications listed in this department are obtainable from the manufacturer without charge.

Full Automatic Conveyors

A new *Bulletin No. FA-102* has been issued by the *Hanson-Van Winkle-Munning Co.*, Dept. MF, Matawan, N. J., on full automatic electroplating conveyors.

This bulletin describes all of the full line of conveyors made by the Company, including the Elevator type, the Munning type, the Straight Line type, and a variety of special plating machines such as caustic cleaning lines, tin plating lines, machines for plating wire, cable, zippers, etc.

The bulletin is profusely illustrated with photographs and with phantom assembly drawings of the Elevator type and the Munning type conveyors.

Metal Parts Washing

A new, illustrated bulletin (*No. 6E1*), describing standard models of metal cleaning and drying equipment manufactured by the *Optimus Equipment Co.*, Dept. M.F., 127 Church St., Matawan, N. J., has recently been published.

Feature of the book is a table showing how seven basic type units can meet and handle twelve operating conditions. A minimum number of washing, rinsing, and drying machines, adaptable to a large number of metal processing operations, are fully described.

The manufacturer states that Optimus parts washing equipment is designed for

ease and speed of handling. Many of the units are movable, and all are planned to take up a minimum of floor space. They can be used in connection with a wide variety of systems, with the parts being brought to the machine on belts, racks, or in baskets.

The machines described in the bulletin are also adaptable, in many cases, for use in drying operations, using hot or cold air, and steam, gas, or electrical heating.

Optimus detergents, a companion product, for the cleaning of both ferrous and non-ferrous metals, are also described in the bulletin.

Bus Duct

To aid in the selection and application of a bus duct system to provide flexible, accessible power in industrial plants, a new data book is announced by the *Westinghouse Electric Corp.*

The new 40-page booklet diagrams and analyzes step by step three typical bus duct installations. Drawings and photographs of the duct components illustrate the ease of installation, sturdy construction and trouble-free design of the equipment. The engineering data section of the booklet includes standard ratings of main breakers, temperature conversion tables, formulas for determining amperes, horsepower, kilowatts and kilovolt-amperes, and load power factor curves, and other information designed to aid in correctly applying bus duct, and in selecting power take-off devices.

Copies of the new booklet (B-3714) may be secured from the Westinghouse Electric Corp., Dept. MF, P. O. Box 868, Pittsburgh 30, Pa.

Polishing Room Accessories

An unusually complete catalog of polishing room accessories is announced by *The Manderscheid Co.*, Dept. MF, 810 Fulton St., Chicago 7, Ill.

Included in *Presto Bulletin* 103 are semi-automatic tube polishing machines, work holding spinners, balance ways, wheel rakes and many small items that save time and increase efficiency.

Metal Processing

The *Kelite Metal Processing Bulletin*, a new booklet published recently by *Kelite Products, Inc.* is made up of twelve pages of facts and photographs describing the pH Controlled cleaning methods and materials made available by this company for the metal industries.

Many cleaning problems found in metal processing and finishing operations are illustrated and discussed briefly; electro-cleaning, still cleaning, preparation for painting, anti-rust methods are but a few. Cleaning materials for various kinds of metals covering aluminum, brass, copper, die cast and ferrous metals are also discussed.

Of interest is Kelite's suggestion service, as an aid in the planning or supervision of new production cleaning systems or in reorganizing and modifying old; also Kelite's Control Service Reports, designed to keep managers and superintendents advised as to the function and efficiency of their cleaning and processing operations. Both of these customer services are also covered.

Copies are available by writing to Kelite

Products, Inc., Dept. MF, P. O. Box 2917, Terminal Annex Station, Los Angeles 54, Cal.

Industrial Service Booklet

Behr-Manning Corp., Division of Norton Co., Dept. MF, Troy, N. Y., has announced a new booklet entitled "*Coated Abrasives in the Plastics Industry.*"

The new booklet is claimed to be the first publication on plastics from the "sanding" angle, and in addition to explaining completely abrasive selection, machinery and equipment, buffing, polishing, etc., the entire first half of the booklet is devoted to an introduction and simplification of the plastics themselves. This introductory section clarifies much of the confusion resulting from the hundreds of plastics names by combining similar materials into seven, easily recognized 17" x 22" three-color chart enlarged from the center spread of the booklet and listing complete reference data on 70 of the popular rigid type plastics.

Metal Cleaner

A pamphlet on the use of Pennsalt PM-90, a new acid-type chemical-cleaner for metals, has been issued by the *Special Chemicals Division of the Pennsylvania Salt Mfg. Co.* It suggests methods for removing boiler scale, general pickling operations, cleaning of heat transfer equipment and stripping zinc plate. The pamphlet is available on request at the company's main office, Dept. MF, 1000 Widener Bldg., Philadelphia 7, Pa.

Rubber Lined Tanks

A new 12-page catalog section on its line of Vulcalock rubber-lined tanks and tank cars for handling corrosives has been published by *The B. F. Goodrich Co.*, Dept. MF, Akron, Ohio, and is now available upon request.

The catalog section describes the company's Vulcalock process, by which rubber can be attached directly to the surface of metals with an adhesion exceeding 500 pounds per square inch, in practically an integral union. This process has revolutionized the handling of corrosives since it makes it practicable to combine the stability of metal with the unequalled corrosion and abrasion resistant properties of flexible rubber.

Liquids successfully and economically handled with rubber linings include muriatic acid, phosphoric acid, hydrofluosilicic acid, hydrofluoric acid (50 per cent), sulfuric acid (50 per cent), acetic acid, ferric chloride, formaldehyde, caustic soda and potash, calcium and sodium hypochlorite, and other commonly used commercial liquids except nitric acid, oils and oil derivatives. Koroseal linings are available for some conditions of oil or oxidation where rubber linings are unsuitable because of their property limitations.

Dimensions of standard Vulcalock rubber lined tanks are given in a table and a complete discussion given on methods of preparing the tanks or tank cars for the operation, instructions on how to properly protect the linings, both during and after installation, are included.